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British Society for the History of Pharmacy
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British Society for the History of Pharmacy

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The British Society for the History of Pharmacy was formed in 1967 under the aegis of the Pharmaceutical Society of Great Britain, having originated from its History of Pharmacy Committee.

BSHP seeks to act as a focus for the development of all areas of the history of Pharmacy, from the works of the ancient apothecary to today's ever changing role of the community, hospital, wholesale or industrial pharmacist.

Aims

Promotion of historical studies related to pharmacy.
Advancement of knowledge and propagation of understanding of the history of pharmacy.
Publication of the research work of pharmaceutical historians.
Preservation of pharmaceutical artefacts and historic pharmacies.
Support for the work of relevant museums and offering advice on establishment of other pharmaceutical exhibits and on the preservation of pharmacies.
Co-operation with related professions and local historians on medico-pharmaceutical topics of mutual interest.

Pharmaceutical Historian

The *Pharmaceutical Historian* has been published since 1967, at first intermittently, but on a regular quarterly basis from 1972.

An index for the years 1967-1995 was published in 1998. An index for 1996-2000 was published with the December 2000 issue. Issues generally comprise 16 pages and cover.

Papers, short communications and letters in English on any aspect of the history of pharmacy are welcome and should be sent to the address above or by email to *bshpeditor@associationhq.org.uk*

Any illustrations are converted to monochrome for printing. Further details of requirements can be found on the website *www.bshp.org* under Publications.

Membership

Membership costs £20.00 per annum and includes:

Four issues of the *Pharmaceutical Historian*.

Regular meetings, with guest speakers, usually in November, February and May. (Many meetings are College of Pharmacy Practice accredited for post-graduate education requirement.)

Visits to places of historic interest, museums, collections, botanical gardens, etc.

Annual Conference, usually in March/April.

Free use of Royal Pharmaceutical Society of Great Britain's library facilities for research.

Help in historical research and with the identification of artefacts.

Affiliation to the International Society for the History of Pharmacy (ISHP).

Affiliation to the British Society for the History of Medicine (BSHM).

Application forms are available from the Honorary Secretary at the address above or on *www.bshp.org*

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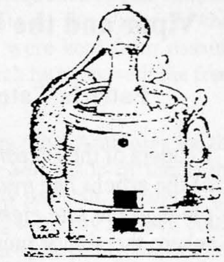
PHARMACEUTICAL HISTORIAN



Editor: Ainley Wade, BPharm, MPhil, FRPharmS
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Diary

Wednesday 19 May 2004 Foundation Lecture
'GPs, patients, and bottles of medicine' by Prof. Anne Digby at RPSGB Lambeth.

2-4 April 2004
BSHP Annual Spring Conference will be held at **Cambridge.**

Wednesday 17 November
'A Pharmaceutical History of Radiology' by Dr Adrian Thomas RPSGB Lambeth.

British Society for the History of Medicine
7 April 2004 Poynter Lecture 'Experimental lives: medicine and the Lunar Society 1760-1810' by Jennie Uglow at Wellcome Building, Euston Road at 3 p.m.

1-4 September 2005
Next BSHM Congress at Exeter.

Advance notice

22–25 June 2005 Edinburgh
37th International Congress of the International Society for the History of Pharmacy
The Congress will be organised by the British Society for the History of Pharmacy. All members of BSHP are members of the ISHP. The BSHP will not be holding its usual Spring Conference in 2005.

Review

Dental Practice in Europe at the End of the 18th Century

Christine Hillam (Editor). Clio Medica 72. Amsterdam and New York: Rodopi, Publisher for Wellcome Trust Centre for the History of Medicine at University College London, 2003. ISBN 90-420-1258-7. pp. 518. No price stated.

The book has a Foreword by David Hillam, a photograph of Christine Hillam, a Preface of two pages, and an Introduction by Christine Hillam. There are short biographies of the contributors, all from western Europe: Pierre Baron (France), Judit Forrai (Hungary), Anne Hargreaves (UK), Christine Hillam, Frank Huisman (Netherlands), Curt Gerhard Lorber (Germany), Thomas Nickol (Germany), and Peter Schrock-Schmidt (Germany). There are six appendices and a good index.

The contributors to the British section included John Beal, Juanita Burnby, John Cannon, Roger King, Henry Noble, Tony Valentine. This involved their reading and listing of all dental advertisements and notices for the last decade of the eighteenth century. To quote from the book,

> 'The folk history of dental practice in the 18th century is peopled by flamboyant quacks, fraudulent charlatans, bungling barbers and blacksmiths', but finishes with 'the state of dental practice of the period highlights how inextricably it is bound up with the wider history of therapeutic provision throughout Europe. Dental practitioners are also seen playing a role in the history of pharmacy and the evolution of the pharmaceutical industry; many a pharmaceutical fortune was built on the manufacture of dentifrices and toothpowders. In Britain, with the virtual demise of the professional toothdrawers, it was the emerging chemists and druggists who were at this period taking over the role of extractors; so intertwined did drug-selling and some form of dental treatment become that until an amendment (1983) to the Dentists' Act, pharmacists retained a right to extract teeth in certain circumstances.' Dr Hillam finishes by writing, 'This description of practice in Europe two hundred years ago clearly addresses itself to the roots of more than the dental profession.'

Christine Hillam, though not a pharmacist, was a member of BSHP and found our work stimulating and enriching. Her husband David Hillam has written in his Foreword after her death, that it was her great desire and dogged determination together with extraordinary effort on her part that she succeeded in completing this very fine book. **J. Burnby**

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Moyse Charas, Francesco Redi, the Viper and the Royal Society of London

Patrizia Catellani and Renzo Console

Readers of the *Pharmaceutical Historian* will be aware of the article *The treatment of poisoning from classical times to the late eighteenth century* by W.A. Jackson,[1] where the author mentions the poison of the viper as a threat to people working in the countryside and to their domestic animals, and the use of viper's flesh in the past as an antidote against its poison.

We would like to give a brief account of the extraordinary interest shared by two respected scientists of the 17th century in the anatomy of the viper, the nature of its poison and the possible use of its flesh as an antidote.

The older of the two was the French *apothicaire*, pharmaceutical chemist and physician Moyse Charas (1619-1698); the other was the Italian scientist, physician and poet Francesco Redi (1626-1698). Their common interest in the viper, however, did not mean that they shared the same views on the subject. In fact, they had a long dispute that was never resolved during their lifetime. Their dispute also became known in England, particularly to the community of scientists who were members of Royal Society of London in its early years. We are going to use 17th century British sources to describe that 'Continental' dispute from a British perspective.

Moyse Charas

Charas (*see* Figure 1) was the best known French pharmacist and pharmaceutical chemist in the second half of the 17th century before his fame was rivalled and somewhat obscured by his famous younger colleague Nicolas Lémery. He was also a skilled practitioner of medicine.

Charas wrote three treatises that are still remembered: *La Thériaque d'Andromachus* (1668), the *Nouvelles Expériences sur la Vipère* (1669) and the *Pharmacopée Royale Galénique et Chymique* (1676). He also claimed to be the real author of the *Traité de la Chymie* (1663) published under the name of the Swiss chemist Christoph (or Christophe, or Christophle) Glaser.

The range of Charas' interests was very broad in the fields that today we would call physics, chemistry, pharmacology, biology, therapeutics and even in Latin poetry. He had an inquisitive mind and enjoyed investigating all sorts of phenomena, although his experiments and theories were sometimes strange and caused some controversy.

One of his greatest interests was in studying the viper, its anatomy, the nature of its poison and the medicinal use of its flesh. But this was not just an isolated sign of his curiosity. It was a focal point of his studies and research, because the viper was linked, as an ingredient, with theriac, which Charas prepared with great skill.

Figure 1. Moyse Charas (1619-1698). The Wellcome Library, London.

Charas was a Huguenot, i.e. a French Protestant (like Lémery) and had friends, protectors and correspondents in various European countries, such as Britain, Holland and Spain. He relished his international contacts and had his works translated into other languages, including English, and published abroad.

Andromachus' Theriac

Charas enjoyed much success in Paris between 1667, when he performed his first public preparation of theriac (also called Venice treacle in Britain), and 1680, when Louis XIV drastically reduced the professional rights of the Huguenots. During this period Charas was chosen as apothecary to the Duke d'Orléans, the King's brother, and was appointed demonstrator of chemistry at the Jardin Royal des Plantes in Paris. At this time he wrote his works in French but also started publishing them abroad in other languages.

Charas also became known and appreciated in Britain. His first two French works were reviewed in 1670 in the *Philosophical Transactions* printed by John Martyn for the Royal Society of London. The first review, of *La Thériaque d'Andromachus*,[2] begins with this explanation:[3]

> As there are above 60 sorts of different druggs, which are ingredients of this no less difficult than famous and usefull Medicine, which was invented by *Andromachus*, Physitian to *Nero*; and as those drugs are subject to be sophisticated, and require different preparations, so there are few men, that are sufficiently skill'd to chuse aright all those ingredients, or dextrous and patient enough to prepare them well. The Author of this Book

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[...] is of opinion, that commonly there are committed many faults in preparing the Ingredients, of which the Theriack is made up. E.g. When the Vipers are prepared, the custom is to whip them, thereby to make all the venom go to the head, which is cut off when they are sufficiently enraged. [...] Whereas he saith, that it being by Experience evident, that all the venom of the Viper is in his Teeth and Jaws, that whipping is not only to no purpose, but also dangerous, in regard that the Spirits being chafed and irritated may beget venom in the body, where was none.

The viper was known to be immune to its own poison; and therefore the idea was to use viper's flesh as an ingredient of theriac, regarded for many centuries as a universal antidote. But it was important to avoid adding any traces of the actual poison to the antidote. The ingredients used by Charas to make Andromachus' theriac are listed in the Appendix at the end of this article.

The longest chapter of the book (28 pages)[4] describes the preparation of troches of vipers, which was one of Charas' greatest skills – in his own opinion. He first states that female vipers should be preferred; then he gives a long explanation of the reasons why the vipers should be preferably taken in April or October; he then criticises the old methods for preparing the viper, including the habit of discarding the bones and boiling the flesh; and finally he gives a detailed account of his own method.

The Viper

The second review of Charas' works in the *Philosophical Transactions* of 1670 is about the *Nouvelles Expériences sur la Vipère*[5] and gives this account:[6]

The Author of this Curious Book makes it his business 1. To prove, that the biting of Vipers, at least as such as are in *France*, are indeed venomous, and proved actually mortal: Where he alleadges many Experiments, made by himself in the presence of many Physitians and others, evincing this Assertion; in the recitation of which, he observeth not a few remarkable *Phænomena*, seen in the Animals, bitten by Vipers, both without, and also within them when dead and opened; particularly, that he found all their Vitals and Viscera fresh and in a good state, but the Blood in all of them, that were opened, either coagulated already and blackish, or tending towards coagulation.

2. To confute the opinion of those (and by name of the famous Italian Philosopher Redi, who, a few years since, publisht also a book of *Vipers*) that assert, that the Venom of these Animals resides in the Yellow liquor contained in the Bagg about the Vipers teeth; whereas this Author will have it to be in their vexed and enraged spirits: which he thinks, he hath sufficiently proved by wounding several Animals with some of the biggest teeth of Vipers, pulled out, and letting into wounds thus made, and rubbing with that reputed poisonous liquor of the bag; whereupon no ill effects at all have followed. Which he confirms by another tryal, wherein, holding the Jaws of a Viper, and then thrusting its teeth into the flesh of a living Animal, and letting the Juyce of the bag into the wound, no ill consequence appeared, considering that the angred Spirits of the Viper, in that forced and restrained posture, were kept from passing abroad; for the emission of which he supposeth the freedom of the Animal is required.

3. To recommend, among divers other Antidotes for the bitings of Vipers, the *Volatile Salt* made of them; the vertues of which he exceedingly praiseth, alledging the Example of a person, who being bitten by a Viper, could be saved by no other means, but by several *doses* of this Volatil Salt; whose preparation he at larg describeth.

The summary given by the reviewer shows that one important objective of Charas' book was to recommend his 'volatile salt' made with viper's flesh. His method for the preparation of that antidote constitutes a large section of the third part of the work, concerning 'the remedies taken from the viper'. The whole of this part consists of 10 chapters and is 76 pages long.[7]

The review ends with the announcement that '*this Book is likely to be forthwith translated into English, to be printed for the Stationer, that taketh care of these Transactions*'. Charas' work was in fact published in English later in 1670 by John Martyn as *New Experiments upon Vipers* (*see* Figure 2).[8] The title-page explained: 'An exact description of all the

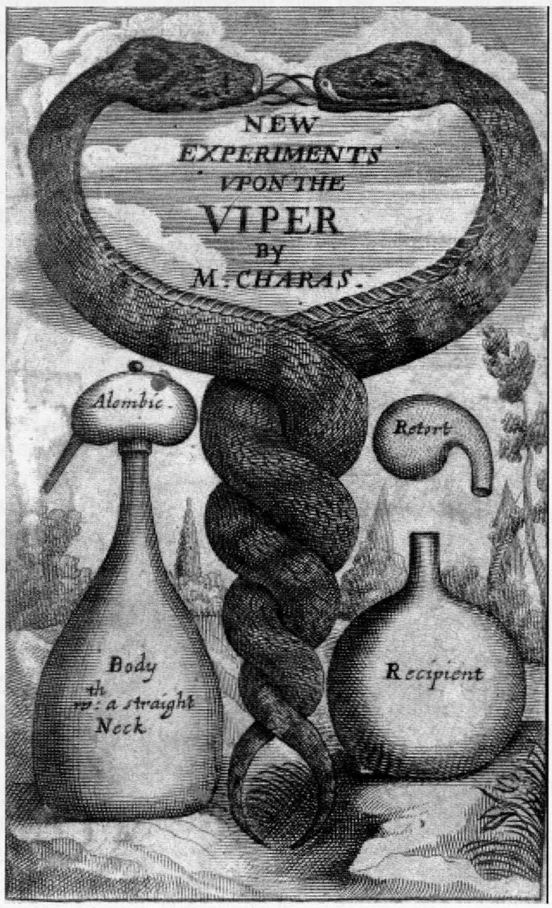

Figure 2. Frontispiece of Charas' English version of his work on the viper (1673). The Wellcome Library, London.

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parts of a viper, the seat of its poyson, and the several effects thereof, together with the exquisite remedies, that by the skilful may be drawn from vipers, as well for the cure of their bitings, as for that of other maladies; originally written in French by M. Charas of Paris; now rendred English.'

It may be interesting to read a summary of Charas' theory of the nature of the viper's poison using his own words, as they were translated into English for the 1670 London edition:[9]

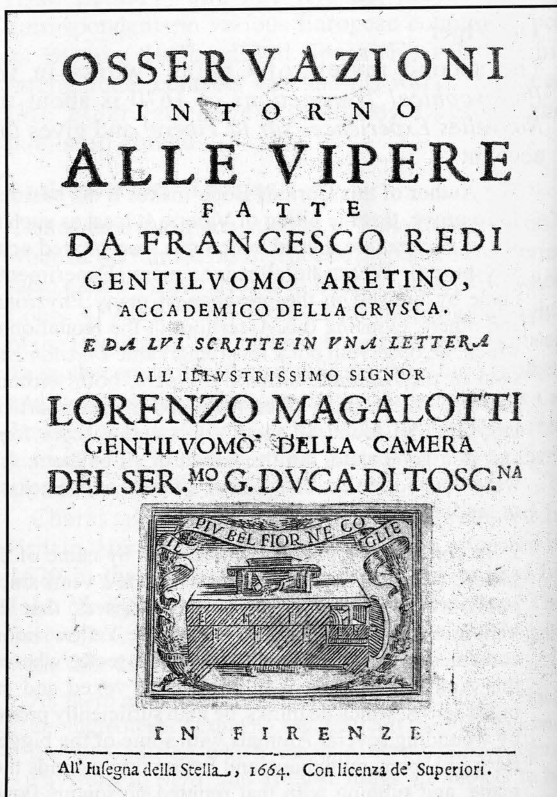
> The Viper is not the only among Serpents, that hath *Salival Glands*; for I have also found of them in the Head of Snakes, which Glands were heaped together longways, and scituated near each outward upper Jaw, serving them for a defence, in a manner, as the Dog-teeth do to Vipers. These considerations, supported by many Experiments, […] have induced me to call these Glands *Salival*, and to ascribe to them the very source of that yellow Liquor, which has been so much decryed, and with-all so little known, and is nothing else, but a pure and very innocent Spittle. […] We conclude therefore, that the imagination of the Viper being irritated by the *idea* of revenge which she had fram'd to her self, gives a certain motion to the Spirits which cannot be expressed, and pushes them violently, through the nerves and their fibres, towards the cavity of the teeth, as into a funnel; and that from thence they are convey'd into the blood of the animal, by the opening, which they have made, there to produce all those effects, of which we endeavour to give a reason. […]. How-ever this be, we must agree herein, that this irritation in the phansy or in the spirits of the Viper is the main cause of the activity and piercingness of its venom, and that without it the biting would not produce such surprising effects, as those are, of which we have related so many Examples.

Francesco Redi

The title *Nouvelles Expériences* (*New Experiments*) given by Charas to his book on the viper did not mean that it was a new version of an earlier work by the same author on the same subject. It rather referred, indirectly, to the work *Osservazioni Intorno alle Vipere* published in 1664 by the Italian scientist, physician and poet Francesco Redi (*see* Figures 3 and 4) in the form of a long letter to Lorenzo Magalotti, a scholar, member of the 'Arcadia' and secretary of the Accademia del Cimento. Redi had made his own experiments on the viper five years earlier than Charas, but his conclusions had been different and simpler: the poison was in the yellowish fluid produced by the viper's glands, and was always harmful when injected into an animal's bloodstream, even if extracted from a dead viper. So Redi had not felt the need for the concept of 'enraged spirits'.

When Redi saw Charas' *Nouvelles Expériences*, he decided to repeat his experiments to make sure that he had not missed something that might had been genuinely discovered by Charas; and did so by concentrating on those findings that seemed different from those obtained by his French colleague. Not only did Redi obtain a confirmation of his own earlier results,

Figure 3. Francesco Redi (1626-1698). United States National Library of Medicine.



OSSERVAZIONI
INTORNO
ALLE VIPERE
FATTE
DA FRANCESCO REDI
GENTILVOMO ARETINO,
ACCADEMICO DELLA CRVSCA.
E DA LVI SCRITTE IN VNA LETTERA
ALL' ILLVSTRISSIMO SIGNOR
LORENZO MAGALOTTI
GENTILVOMO DELLA CAMERA
DEL SER.MO G. DVCA DI TOSC.NA

IN FIRENZE
All' Insegna della Stella, 1664. Con licenza de' Superiori.

Figure 4. Redi's first work on the viper (1664) that provoked Charas' response.

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but he also found that ingestion of viper's flesh did not provide any protection to animals bitten by vipers and did not prevent the ill effects of the bite. In fact Redi, as a physician, never liked the complicated medicines of the *speziali* (apothecaries) and preferred to rely on diet, pure water, hygiene and simple remedies.

Redi's reply to Charas was published in 1670 as *Lettera di Francesco Redi Gentiluomo Aretino, Sopra Alcune Opposizioni Fatte alle Sue Osservazioni Intorno alle Vipere* (addressed this time to the abbot Bourdelot and Alessandro Moro). We give a summary in Redi's words as they were translated into English in 1673:[10]

> The Poison of a Viper is nothing else than a certain yellowish liquor, which lodges in the vesicles that cover the greatest teeth of the Viper; and […] that Juice is not only poisonous, when it is ejected by the live Viper when she biteth, but also when 'tis collected from a dead Viper, and even such an one that hath been dead many days, provided it be made to pass into a wound, and remain there. Moreover, […] this same liquor, when taken down into the stomach, is not deadly, no not so much as noxious.

The Italian author also added a comment that sounds rather ironical:[11]

> The poison of the *Italian* Viper consists not in an imaginary *idea* of anger raised to revenge, but rather in that yellow liquor, which is voided out of the bags of the bigger teeth of Vipers […]. I should think it very well worth while for those learned Authors of the book of the *New Experiments*, that they would please to make their Experiments anew. And if they shall find them conform to those they have already published, and really contrary to mine, then we may unanimously conclude, that we have lighted upon a truth hitherto unknown; which is, That the Poison of the *French* Vipers consists in an imaginary *Idea* of a revengeful anger; but that of the *Italian* ones hath its seat in that yellow liquor, so often mentioned by me. But if on the other side, the *French* Experiments should not hold, then it may be affirmed, that the *French* as well as the *Italian* Vipers are of one and the same nature; and have the same kind of poison.

At the end of his letter Redi explains his findings about the virtues of viper's heads as an antidote:[12]

> Having read them in the Book of the *New Experiments*, that the Head of a Viper, being eaten of an animal, bitten by another Viper, did certainly cure the wound; and the thing being by me looked upon as very useful, excellent, and admirable, I had an eager desire to try it my self, that I might speak of it with more confidence, although those learned men had made […] two […] experiments of it. Hereupon I resolved to imitate those Gentlemen, and having given a Vipers head half boiled to a chain'd young Dog, I caused him immediately to be bitten by an other Viper in the right ear, but the Dog dyed not, nor did he appear to me to have any other inconvenience than that he stood as 'twere amazed, and looking grim, and melancholly, for four or five hours space. I soon reiterated the same Experiment upon another Dog, which having been forced to swallow the head of a Viper, raw and bruised in a Mortar, gave no sign of any great poison, and had very little and almost no ill ensuing. Whence I was ready to reckon this Experiment among things proved and true, when a doubt coming into my mind, obliged me to cause two other young Dogs to be bitten in their ears, who although they had not eaten the counter-poison of a Vipers head, yet dyed not.'

At this point Redi became suspicious, and had a number of dogs, cats, birds and hares bitten by vipers in the thigh after they had eaten viper's heads: they all died. Charas, and initially also Redi, had the mammals bitten only in the ear; and that appears to be the reason why they did not die, rather than the effect of the 'antidote'.

Redi's conclusions on the non-existent value of the viper as a counter-poison were tantamount to anathema against 1600 years of pharmaceutical tradition since the time when Nero's physician Andromachus had composed his theriac by adding viper's flesh to mithridatium. Charas had written and published more than 100 pages describing the therapeutic virtues of viper's flesh and organs. So he did not like Redi's results. He also repeated and extended his own experiments, obtaining exactly the same results as before. These new experiments were published in 1671 as an addition (called *Suite des Nouvelles Expériences sur la Vipère*) to his earlier book together with the unchanged original text.

Philosophical Transactions

Looking again at the *Philosophical Transactions* (1672) we have an idea of the echo that this further development of the debate had in Britain. It regards the *Suite des Nouvelles Expériences* by Charas:[13]

> This is a Sequel of Experiments, made by the skill and industry of the same, that was the Author of the Tract, entituled *Nouvelles Experiences sur la Vipere*, [...] and since English'd out of French [...]. It is made by the Author in his own defence against a Letter of Signor *Redi*, publisht in Italian against some experiments of the Author's former Book [...]. In it M. *Charas* expresseth, that he is so far from changing his opinion upon his examining Signor *Redi*'s Letter, that he is much more confirmed in it. The Controversie consists chiefly in this:
>
> 1. That Signor *Redi* will have the Yellow liquor contain'd in the bags of the Teeth-gum of Vipers to be the only and true seat of their Venom.
>
> 2. That this liquor is indeed not Venomous being taken at the mouth, but only when let into a wound, made either by the live Animal, or even by a dead ones teeth, thrust into ones flesh after it is dead.
>
> 3. That the same juice drawn from a dead Viper, as well as from a live one, is alwaies venomous, if it pass into a wound and mingle with the bloud of the wounded Animal [...].
>
> 4. That it kills generally all sorts of Animals being wounded, and receiving of this liquor into the wound. Whereas M. *Charas* asserts,
>
> 1. That the Venom of Vipers is only in the enraged Spirits.
>
> 2. That the Yellow liquor, as well of a live and even a much angred Viper, as of a dead one, hath no Venom at

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all in it, neither in the biting, nor when taken inwardly, nor let into a wound and mixt with the bloud, nor any other way; and consequently that it kills and infects no kinds of Animals, but is a pure and very innocent *Saliva*. [...] And, as to the bilious expirations of Vipers, which may intervene with the Yellow liquor and render it venomous, he saith, That that is nothing but the angred Spirits under a disguise. Now touching the enrages Spirits of Vipers, our Author, though he calls them Spiritual, or not Material, and maketh their Venom not visible nor palpable, yet certainly he will be understood to speak so in comparison to the Yellow liquor, which is a *visible* body; for, 'tis beyond all doubt, that those irritated Spirits are corpuscles, though not such as may be seen and handled like the said liquor, nor such as you may assign a particular place to in the body of the Viper, where they lodge [...]. Nor can he mean, that these Spirits have neither place nor extension; for, how could they part from the Viper without having been in her body; and, how could they enter into the body of the Animal bitten without being there.

Charas also reaffirmed the value of the volatile salt of viper as an antidote to vipers' bites. We feel that the *Philosophical Transactions* reviewer was not totally comfortable with Charas' idea of the 'enraged spirits'; and we should note that Charas was not the originator of this kind of theory. In this respect he was a follower of the Belgian doctor and chemist Jan Baptist van Helmont (1577/1580-1644),[14] whose theories have been described as 'mystifying'.[15]

This debate attracted the attention of a number of curious and learned people. A group of them in Florence, in the same year (1672), discussed the various theories on the viper and also made various experiments. Those sessions were attended by a number of distinguished Italians and Frenchmen, and also by Thomas Platt, who wrote an account in English, and on one occasion by two other Englishmen, Thomas Frederick and John Godscall. The *Philosophical Transactions* printed that account under the title '*An extract of a Letter Written to the Publisher by Mr.* Thomas Platt, *from* Florence, August 6. 1672. *concerning some Experiments, there made upon Vipers, since Mons. Charas his Reply to the Letter written by Signor* Francesco Redi *to Monsieur* Bourdelot *and Monsieur* Morus'. The extract is very long, but some parts may be of interest:[16]

'*Sir*, I shall begin by telling you, that in a Conversation last Winter, where I had the good fortune to make one of the number, the discourse was of an Opinion of M. *Dela Chambre*, who, to prove that the Spirits are animated, alledges, among other arguments, their Aptness to discern; by which he supposes, that in heat of their anger they gather the Poison from the several parts of the blood, and therewith convey themselves to the teeth of the irritated animal, from whence they are afterwards transfused into the wound by biting. This conceit was by some of the Company received with much applause, because they knew, how difficult a thing it was, to come to an explanation of that poison, which M. *Dela Chambre* makes mention of in general, That the spirits proceed from the Blood of the irritated animal. So they agreed, *paucis mutatis*, hence to frame a new *Hypothesis*, saying, That such poison is nothing else but a new and malignant activity of the same Spirits whilst they are vexed and bent towards revenge; asserting the truth of such Ideal effects with divers examples, [...] which were all found very week and un-concluding. Wherefore most of the Gentlemen did incline to entertain Mons. *Dela Chambre*'s first fundamental Opinion, since at least that supposes, That those Animals, that poison by their biting, have already a real poyson within themselves, and that Anger works no other effect, but to gather all the venomous parts together in one particular place, whence they may easily be instill'd into the wounds, made by the teeth.

The discussion continued and Redi's simpler theory, then favoured in Italy, was found relatively more convincing. So those gentlemen decided to reproduce Redi's experiments in late spring, when vipers would become readily available. Various sessions took place in June in the house and garden of Lorenzo Magalotti, to whom Redi had addressed his first letter. The experiments are described in Platt's letter in great detail. Many pigeons, cocks and chickens were wounded using the teeth of dead vipers or were bitten by live ones, and they all died promptly, whether they had eaten viper's heads as an antidote or not. This confirmed the results of Redi's experiments. Platt's conclusion was:

This is, *Sir*, what I can confidently affirm to have been an eye-witness of; and it being not my business to make reflections upon these experiments, I leave that to you. I know, I have not said any thing but what will be most amply found in Sign. *Redi*'s first and 2*d*. book; but that, which urged me to make this repetition, was the thoughts that it might be acceptable to you, to see his Assertions confirmed by the Testimonies of so many persons, that are the more able to be judges of them, because their understandings are such, that 'tis not possible to impose on them.

The Royal Society

Despite his success, Charas was probably conscious of his potentially weak position in France as a Huguenot, and therefore was very keen to be known abroad. We have seen that he had published two editions of his book on the viper in London. In 1676 he completed and published in France his most important work, the *Pharmacopée Royale*,[17] and immediately endeavoured to have it translated into English. The French version was promptly reviewed by the editor of the *Philosophical Transactions*:[18]

This Work of the industrious and experienced Monsieur *Charas*, hath the approbation both of the Illustrious *Parisian* Faculty of Physick, and of the most eminent Physicians of *Paris*, such as are the first Physicians of that King and Queen, the *Dauphin*, and Monsieur the Kings Brother; who give this Testimony to it, that it contains both what is found best in the Ancients, and what has been discovered by the Moderns in *Pharmacy*, and that therefore it may be very useful to all those that addict themselves to the study and practice of Physick.

Charas also had contacts with members of the Royal Society of London and particularly with John Locke

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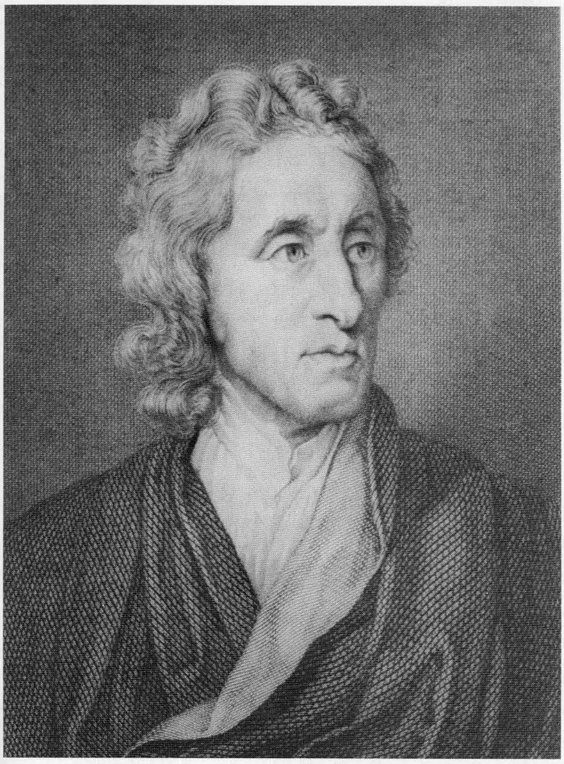

Figure 5. John Locke (1632-1679). United States National Library of Medicine.

(1632-1679), the famous philosopher and physician (*see* Figure 5), who was Charas' guest during his entire stay in Paris from 1677 to 1678 and witnessed some experiments on the viper. Locke wrote in his notebook:[19]

> We have experimented that vipers skins doe perfectly heale the inveterate mange in dogs making them eat boiled or raw. [...] Whether it may not be as effectual for scab or leprosie in men?

Locke also wrote in his journals:[20]

> I saw 2 young pigeons kild with vipers. They died very quickly after the biteing, vomiting up a good deale of liquor just before they died. There was also a young cock bit soe as to fetch bloud. I applyed my stone which stuck of it self and the cock lived above an hower after without any great signes of harme but the impatience of the people not suffering me to let it stay on as long as it would stick, I was fain to pull it off and let the young cock goe, who for a good while after (all the time I was there) run up and downe the haye without any signe of sicknesse. I must investigate further the working of this stone.

Locke's 'stone' was a bezoar. While Locke was in Paris, Charas went to London twice (1677 and 1678) to promote the forthcoming English edition of his *Pharmacopée Royale*. Robert Hooke (1635-1703), the well known physicist and mathematician, and one of the most active members of the Royal Society, noted in his diary:[21]

> *November 22nd* [1677]. [...] Prepared for Experiment of weight in water. Mons. Charras [sic] presented Royal Society *Pharmacopœia Royall*. I shewd Animalls in pepper water and 12 other waters. [...] Shewd experiment of weighing solids to the 1000000th part of their weight.'

Doctor John Mapletoft (1631-1721), a friend of the famous Thomas Sydenham, wrote the same day to Locke:[22]

> This very afternoon I had a glimpse of Mr Charas at the Royal Society, and only just time to salute him. If he would have stayed a little longer wee could have shewed him about 200 animalls, by Dr. Wallis's computation, in the fifth or sixth part of a drop of Water. Wee had such storys written us from Holland and laught at them as perhaps you may doe at this But seeing is beleiving and to that I referre you.

The animals in water were infusoria and were shown by Hooke, as we have seen. John Wallis was a mathematician. The letters from Holland had been written to the Royal Society by the microscopist Antoni van Leeuwenhoek.

Charas was briefly in London again in 1678, as we read in a letter written by the physician Thomas Coxe (1615-1685) to Locke:[23]

> Monsr Charras [sic] brought mee your letter of Recommendation for himselfe, and renewed respects and kindenes to mee; which truly I intended to have answerd by him, but slipt the opportunity.

It is conceivable[24] that one of the purposes of Charas' visits to London was to supervise the preparation of the English translation of his *Pharmacopée*, which was actually printed in 1678.[25] The book was promptly reviewed by the Royal Society under the title '*The* Royal Pharmacopæa, Galeno-Chymical, *according to the practice of the most eminent and learned Physitians of* France*, and published with their several approbations; by Moses* Charras *[sic], the Kings chief Operator in his Royal Garden of Plants; in* English':[26]

> The diligent and Ingenious Author having some years since received Order and Directions from Monsieur *Anthony d'Aquine* [sic], primary Physician to the *French* King, for composing a *Galeno-Chymical Pharmacopœa*: his Industrious pursuance of the same from year to year, hath at length produced this Work. The greater part of the Contents whereof, although well known to most learned Physicians; yet because there are also amongst them many uncommon Experiments, and all made with great accurateness, and deliver'd with equal perspicuity: it doth therefore very well deserve [...] [an] account.

The review continues with a detailed description of the four parts of the book. The reviewer was of the opinion that most of the content came from earlier works by distinguished authors; but Charas mentioned very few of them and insisted at great length on the originality or superiority of his own methods for the preparation of his remedies.

Charas in England

In 1680 Louis XIV decided that the Huguenots must convert to catholicism or lose all their professional rights. Charas, who did not abjure his religion, lost his jobs as teacher of pharmaceutical chemistry and as *apothecary*. So he chose to move to England with all

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his family, who joined him here shortly afterwards. We find Charas at a session of the Royal Society of London, which took place shortly after his arrival in this country:[27]

> 1680, *March* 25. Mr. HENSHAW Vice-president in the chair. [...] The president then came in, and took the chair. Dr. CROUNE introduced mons. CHARRAS [sic], who presented the Society with a printed account of the observations of Dr. JOHN BAPTISTA ALPRUNUS, physician to the empress ELEONORA, intitled, *De Contagione Viennensi Experimentum medicum*, &tc. together with a paper of his own, containing his thoughts and animadversions thereupon.

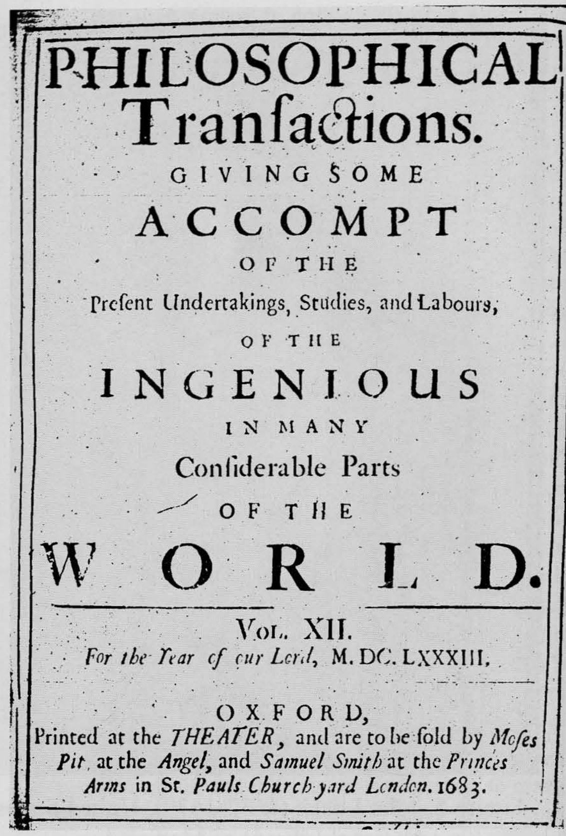
A discussion followed between Croune and Hooke on the 'ferment of the stomach'. It is not clear whether Charas read the two papers in Latin. He was very skilled in languages and appears to have had no problems in that respect during his stay in England and later in Holland and in Spain over a period of 11 years in exile; but probably he was not fluent in English when he arrived in London. Thomas Henshaw and William Croune, coming from Oxford, had been founder members of the Royal Society. The president at the time of this session was Sir Joseph Williamson (1633-1701), a high-placed politician and diplomat in the government.

Charas' skills and credentials were well appreciated by King Charles II, who appointed him his apothecary. In 1681 Charas returned very briefly to Orange, where he had started his career as an *apothicaire*, to qualify as a doctor at the local university[28] and after that he also practised medicine in England and in other countries. The entire Charas family was naturalised British in 1682[29] and remained in England until 1683, when Charas moved to Amsterdam, followed shortly afterwards by the members of his family.

The Rattlesnake

The debate on the nature of the poison of vipers and other snakes did not end with the unresolved dispute between Charas and Redi on the subject. While Charas was still in England, some scholars were questioning rather than dismissing his findings, but an extensive research done by Edward Tyson on the rattlesnake failed to confirm some of Charas' findings. Doctor Tyson (1651-1708) is still remembered as a distinguished and very skilled comparative anatomist. In his essay he assumed that there must be anatomical similarities between all poisonous snakes, and therefore made reference to Charas' studies on the viper while describing the American rattlesnake in great detail. Tyson's essay was printed in the *Philosophical Transactions* (*see* Figure 6) under the title 'VIPERA CAUDI-SONA Americana*, Or the* Anatomy *of a* Rattle-Snake*, Dissected at the* Repository *of the* Royal Society *in* January 1683, *by* Edw. Tyson *M.D.*' and mentioned Charas' work on the viper several times:[30]

> We observed two [...] orifices which [...] led into those two *Baggs* which I have taken the liberty to call the *Scent-baggs*. *Charas* is much mistaken, who supposes



PHILOSOPHICAL
Tranſactions.
GIVING SOME
ACCOMPT
OF THE
Preſent Undertakings, Studies, and Labours,
OF THE
INGENIOUS
IN MANY
Conſiderable Parts
OF THE
WORLD.
VOL. XII.
For the Year of our Lord, M.DC.LXXXIII.
OXFORD,
Printed at the *THEATER*, and are to be ſold by *Moſes Pit* at the *Angel*, and *Samuel Smith* at the *Princes Arms* in St. *Pauls Church-yard London*. 1683.

Figure 6. Title-page of the Philosophical Transactions (1683), where Charas' work was reported a number of times.

> them to be the *Parastates* or Conservatorys of the Seed [...]: and I the more wonder at this his mistake, since he could not but have observed them as I have in the female *Vipers* too; which sufficiently shews his error.

On the subject of the 'organs of generation' Tyson found that Charas was 'unhappy in the description of some of them', and particularly about the unequal length of the two 'testes'. Moving on to the description of the teeth and trying to inspect the source and the path of the poisonous fluid, he had some difficulties and referred the readers to the work of Monsieur Charas and Signor Redi on the Vipers, which are not dissimilar from the rattlesnake in this respect (*see* Figure 7). Then he added:

> Indeed scarce any Subject in Philosophy has admitted more controversy's than this of the Poyson of *Vipers*; in what it consists, what it is, and how it produces it's dire Effects. [...] Of late, famous has bin the contest between *Sen. Redi*, a Noble *Italian*, Mr. *Charas* a *French-man*. 'Tis *Redi*'s opinion, That the Yellow liquor contained in the *Vesicles* of the *Gummes* of the *Vipers*, is the only and true seat of the Poyson [...]. But Mr. *Charas* wholly opposes this, and asserts, That the Poyson of a *Viper* is no where but in her inraged Spirits; That the Yellow *Juice* [...] of a [...] Viper [...] contains in it no poyson at all [...], and that it is nothing but a meer innocent *Saliva*. Both insist upon Experiments for the proof of their own opinion, which being sufficiently known, I shall not here repeat, or interpose in the Controversy. [...] I am not yet so fully convinced

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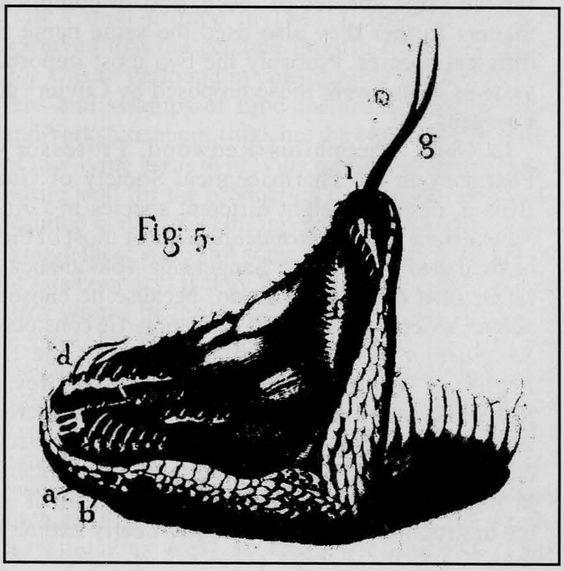

Figure 7. Edward Tyson's drawing of the rattlesnake's head showing its jaws and teeth. *Philosophical Transactions* (1683).

> (tho I have a just Deference for Monsieur *Charas*, and a due regard for his laborious Researches and Inquiries) of the sentiment of the Innocence of this Liquor.

We have omitted long parts of Tyson's quotation of the dispute, which only repeat what we have seen in the *Philosophical Transactions* of 1672. Being an anatomist and not a physiologist, he abstained from intervening in detail, but had doubts about Charas' further explanation of the functions of the 'innocent saliva'.

Summary

We have described the 17th century dispute on the nature of the poison of the viper and its possible use as an antidote which arose between Francesco Redi and Moyse Charas, using documents published in Britain at that time. We have also seen the reciprocal interest of Charas and members of the Royal Society in each other's work, and how Charas settled in England for a few years at the time of discrimination against the Huguenots in France.

We prefer to leave any conclusions from this story to individual readers. However the dispute seems to be part of a transition from an animate view of the world to one where empirical methods do not appear to need to invoke 'spirits'. The story also seems to illustrate the limitations of the empirical method - that even with repetition of experiments there can still be disagreement.

If there is a the feeling that the subject is of interest, we can broaden it to cover scientific exchanges and connections between British and French scholars in the field of pharmaceutical chemistry in the 17th and 18th centuries. At that time a number of pharmacists and scientists moved or corresponded between the two countries influencing one another. That was when modern chemistry gradually evolved out of traditional origins.

Appendix

The ingredients used by Charas to make Andromachus' theriac were:[31]

> Scille; Trochisques de Viperes; Trochisques d'Hedichroüm; Marum; Amaracus; Asarum; Aspalath; Mastich; Poivre long; Opium; Roses; Iris; Suc de Reglisse; Bunias; Scordium; Xylobalsamum, Carpobalsamum & Opobalsamum; Cinnamome; Agaric; Myrrhe; Costus; Saffran; Cassia lignea; Spica-Nard; Schœnanthos; Encens mâle; Poivre blanc & Poivre noir; Dictame de Crete; Prassium album; Rhapontic; Stoechas Arabic; Persil de Macedoine; Calament de Montagne; Terebenthine de Chio; Gingembre; Pentaphyllum; Polium Montanum; Chamæpitys; Storax Calamite; Meü Athamantique; Amome; Acorus verus; Nard Celtique; Terre de Lemnos; Grande Valeriane; Chamædrys; Folium Indum; Chalcitis; Gentiane; Anis; Fenoül; Hypocistis; Gomme Arabique; Petit Cardamome; Seseli de Marseille; Acacia vera; Thlaspi; Hypericon; Ammi; Sagapenum; Petite Aristoloche; Daucus de Crete; Bitume de Iudée; Opopanax; Petite Centaurée; Galbanum; Castor; Miel; Vin.

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Collecting Leeches

W.A. Jackson

A feature of many nineteenth century pharmacies was the elaborately decorated jars which held live leeches, supplied for the purpose of bleeding patients. The practice of removing blood from a human body as a therapeutic measure to treat a medical condition has been practised for thousands of years, and its origin is no longer known. Certainly it was used from classical times until the 1950s.

Three main methods were employed:

1. opening a vein with a sharp instrument such as a lancet, known as venesection;
2. scarifying or cutting the skin and applying suction by means of a vessel in which a vacuum was produced to draw out the blood, known as wet cupping; and
3. the application of live leeches that would puncture the skin themselves and suck out the blood.

Venesection was the method most widely used, followed by wet cupping, but leeching became more popular towards the end of the eighteenth century, and in the first half of the nineteenth century it was used to such a great extent that the leech disappeared from many areas due to the number of them collected for medical use.

Where were the leeches destined for pharmacies obtained and how were they collected?

Leeches

There are approximately 650 species of leeches, and although their habitats vary widely, they are found most frequently in ponds, streams and marshes.[1] At the beginning of the nineteenth century no standard system of classification had been adopted by naturalists. Different authorities used different names for the same species of leech, and to complicate matters further they also used the same name for different species. Probably the two most important systems in use were those proposed by Cuvier[2] and Linnaeus.[3]

In 1847, Theophilus Redwood, Professor of Pharmacy to the Pharmaceutical Society of Great Britain, described eight different species in *Gray's Supplement to the Pharmacopoeia*. For most of them he used the French name 'Sanguisuga' (blood-sucker) rather than the Latin 'Hirudo' because he chose to adopt Cuvier's system of classification. He considered *Sanguisuga medicinalis*, also known as the Old English or Speckled leech, Hamburgh (sic) Grey, or Russian leech to be the most valuable commercial leech. It was imported from Russia, Norway, Sweden etc. via Hamburgh (sic). It had formerly been obtained in England but due to the great demand for it and the destruction of its haunts, it was nearly extinct by then.[4]

A few years before this in 1841, Hudson and Son, importers and wholesalers of leeches, described nine species.[5] However, they had adopted the Linnaean system of nomenclature where possible in which the medicinal leech was named *Hirudo medicinalis*, and it is by this name that it is usually known today. They too considered this to be the best leech to be employed in bleeding, but due to its scarcity they found it necessary to import other species in order to supply the demand in England.

Hirudo medicinalis is a parasitic annelid worm. Each end of the body terminates in a disc-shaped sucker, and progress is made in a looping motion by alternately expanding and contracting the body with each sucker being released and attached in turn. The jaws are to be found in the anterior sucker, and produce a triangular or triradiate bite, through which the host's blood is sucked. The salivary glands produce hirudin (an anticoagulant), hyaluronidase (this increases the permeability of human skin), an histaminic vasodilator, and mucus that acts as a lubricant. Once blood is drawn the leech continues to suck until it is gorged, when it falls off. If it was considered necessary to remove it before this, the application of a little salt to the leech was usually effective.

Collecting Leeches

Sources

In the early part of the nineteenth century Anthony Todd Thomson said in his *London Dispensatory* that many of the leeches that were brought to the London market came from Norfolk, though other sources were Suffolk, Hampshire, Kent, Essex and Wales. They were also imported from Bordeaux and Lisbon, but these were of a different species, having a belly of one uniform colour, unlike the English specimens that had pale olive bellies thickly spotted with black or very dark blue irregular spots.[6]

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In a tract printed in 1841 J. Hudson and Son observed that the genuine English *Hirudo medicinalis* was to be found in considerable numbers in the fens and swamps of Lincolnshire, Cambridgeshire and Yorkshire about 1800, but the systematic draining of low-lying areas to provide pasturage for cattle and fertile land for the production of corn had gradually resulted in its virtual disappearance from these areas, though there were still some to be found in the region of Glastonbury. If they had still been available, the firm would have dealt only in English medicinal leeches, for he considered these to be the best, but they now imported German grey speckled and French green leeches. These two types were seldom found together, and by 1840 the grey speckled ones were being imported from Germany, Russia, Norway and Sweden, and the green from more southerly regions, such as France, Spain, Portugal, and the Mediterranean as well as eastern countries. They considered the grey to be far better than the green for medicinal use.[7]

England was not the only country in which indigenous leeches became scarce. Manchester medical historian, William Brockbank, observed that at the beginning of the nineteenth century France could supply all her own needs, but due to the vast numbers that were used in surgery, particularly in the crowded Paris hospitals, it became necessary to import them from Spain and Portugal. As their stocks became depleted more were obtained from Italy and Bohemia, and from the vast marshes of Hungary but even these were beginning to fail by the middle of the century, and it was necessary to turn to Poland, Russia, Syria and Turkey for supplies. Between 1827 and 1844 France imported an average of twenty seven million leeches each year[8]. They were sent in bags of leather, closely woven cloth frequently dipped in water, barrels and stone jars. Many made the journey from Budapest to Paris in bags that were laid on hammocks stretched across a wagon drawn by relays of post horses. Local collectors would take their catch to depots. Strasbourg was one of these, and here the leeches were stored in zinc baths until they were packed for despatch to Paris. At one time 60,000 to 80,000 were being sent daily.[9]

In 1846 the *Pharmaceutical Journal* reported that M. Chevalier, Professor of the School of Pharmacy in Paris, had published a pamphlet that gave the number of leeches imported into France between 1827 and 1844 as no less than five hundred million, a figure that is slightly greater than that quoted by Brockbank. During this period the price had risen from fifteen cents to forty cents each. Chevalier said that the greed of leech merchants, who had collected and sold all the leeches, young and old, that they could find, had resulted in the loss of the entire native breeding stock. He also accused the wholesale dealers of fraud. They sold leeches by weight, and a thousand small leeches weighed about two and a half pounds, but they adopted the practice of feeding them on the blood of sheep or other animals so that their weight was increased to approximately four and a half pounds. Not only did this mean that they obtained nearly twice as much money for their leeches, but gorged leeches had little desire to suck blood from doctors' patients and were not nearly as efficient as hungry ones.[10]

Methods of Collection

Leeches were caught in spring and autumn by people who waded into the pools where they lived, often beating the surface of the water with poles, which brought the leeches to the surface of the water.[11]

The method of catching leeches pursued in La Brenne, an area in central France covered with small lakes and marshland, was described by a French physician in the first half of the nineteenth century:

> you may meet with a man pale, straight-haired, with a woollen cap on his head, and his arms and legs naked, walking along the borders of the adjoining marshes, among the spots of ground left dry by the retreat of surrounding waters, but particularly where the vegetation seems to preserve the subjacent soil undisturbed: this man is a Leech Catcher. To see him at a distance, from his woe-begone aspect, his hollow eyes, his livid lips, his singular gestures, you would take him for a poor creature, who, in a fit of delirium, had left his sick room. If you observe him, every now and then he will lift his legs, and examine one after the other, you would suppose him insane, but this man is an intelligent Leech Fisher.
>
> The little animals attach themselves to his legs and feet, as he moves among the haunts; he feels their presence from the bite, and gathers them as they cluster around the roots of the 'calamus aromaticus' and other herbs found in marshy ground, or beneath the stones covered with green and gluey moss. Some repose on the mud, while others swim about, but so slowly as to be easily gathered with the hand. In a favourable season, it is possible, in the space of an hour or two to store ten or twelve dozen of them into a little bag which the gatherer carries on his shoulders. Sometimes you may see the Leech Fisher armed with a sort of spear or harpoon, with this he deposits pieces of decayed animal matter in places frequented by the Leeches. They soon gather round the prey and are presently themselves gathered into a vessel containing water.[12]

The leeches gathered in this way were stored in water because if they were placed in a bag they were liable to regurgitate the blood absorbed from the bait and this generated diseases amongst them. The method described above is used in the Spring but in Summer the leeches retired into deeper water and the gatherers stripped themselves naked and walked in the water immersed up to the chin. Sometimes they made little rafts from twigs and rushes from which they picked out the leeches that gathered in these. This way of life was not the healthiest for the gatherer spent much of his time in water 'breathing fog, and mist, and foetid odors (sic) from the marsh',

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LEECH FINDERS.

and often suffered from the ague, catarrh and rheumatism. Although this mode of life was both unpleasant and unhealthy it was lucrative and gave employment to many people. Not only did they supply local pharmacists but many were exported and there were regular traders who acted as wholesalers, including Henri Chartier whose visits were eagerly anticipated by the local leech catchers. One of these traders with the leeches caught by himself and his children and those he purchased could obtain about 20,000 in the course of a month or two. Normally the carriers packed them in bags and suspended these from staves that were placed across a cart, though if he were carrying other goods the bags of leeches could be crammed amongst these. They were moved into depots as quickly as possible where they were allowed to rest and recover, and by relays of about three hundred miles at a time went on to other depots for rest and recuperation until they reached Hamburg. From here those destined for England were shipped to Hull, completing a journey of approximately 1500 miles.[13]

Sabine Baring-Gould, who was an antiquary, parson and West-country squire recorded that in the nineteenth century in La Vendée he had seen bare-legged men wading in the water to collect leeches. These clung to their legs, and although they were removed before they had absorbed too much blood, the men of the area were less 'rubicund' and 'lively' than the women who did not take part in this activity.[14] They were collected in a similar way in this country, though here it was women, not men, who did the collecting. This is shown in the accompanying illustration, *Leech Finders,* in which the central figure is in the act of transferring a leech to a barrel that contained some water and was suspended at her waist by a strap that went over one shoulder. The original of this illustration was published in Leeds in 1814 in *The Costume of Yorkshire*, by George Walker, and was engraved by R. Havell after a drawing by George Walker.

The same method was used by men in Greece in the nineteenth century on the borders of Lake Copios. They were said to do this for two or three months each year, and could make as much as twenty francs a day, about half of which was spent on drink. In addition, another very lucrative but distressing method was employed. Old, worn-out horses were driven into the water and left there until they began to tremble. When they were brought out, their legs and bellies were covered with leeches. These were removed and the horses were left to recuperate on some nearby waste land for four or five days, after which they were driven into the water to act as live bait again. Towards the end of the season the horses, by this time so weak as to be virtually unsaleable

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were only taken from the water long enough to remove the leeches before being driven back again, without even being given time to feed. They were driven in until their bodies were submerged, and eventually became so weakened that they could no longer stand, and had to be dragged from the water. The leeches were stripped off, and, according to one report, the horses were then flayed while they were still alive.[15]

The use of horses and cattle being used as live bait to collect leeches is confirmed in Maunder's *Treasury of Natural History* printed in 1878. He also added that children were employed to catch them by hand, as well as adults wading in shallow water in Spring and picking off those which adhered to their legs. A few were trapped by becoming entangled in rafts constructed from twigs and rushes, and raw liver was used as a bait, though leeches caught by this method were said to become sickly.[16] Leeches normally come to the surface of the water before a thunderstorm, and this was considered to be the best time to collect them.

In Australia up to the end of the nineteenth century, bleeding and blistering were frequently used by the aborigines, and an interesting method of obtaining leeches was described by a collector, Horace Wheelwright, in 1861. A sheepskin was thrown into a swamp or stream inhabited by leeches, and when it was withdrawn it would be covered with them. They were pulled off, and were so plentiful that they could be sold for one shilling a dozen. They were extremely important in colonial medicine, and many thousands were collected and used. Kept alive in casks or jars containing water, they were still on sale in Sydney, price one shilling or more each, in the 1930s, being taken home by patients in small wooden boxes containing damp cotton wool. They were used mainly for swellings and bruises, especially black eyes.

In the 1860s a cargo of leeches was shipped to England, but these were said to have been dumped in the Thames due to a decline in the demand for them in this country.[17] A different explanation for this was offered by Graem Sims in an article 'Leech Mania' – that the leeches that had been packed with clay and vegetation in moist hessian bags and shipped to England were released into the Thames to replenish its stocks. I must say that the former explanation seems the more likely.

He also mentioned the collection of leeches on sheepskins, with the added details that these were from freshly killed sheep, and were pegged, fleece side up in ponds, to collect the fine alluvial gold that was suspended in the water, when the leeches would attach themselves to the underside. Professor Laurence Richardson reported that an aborigine in north Perth collected them by stripping and wading into water at a secret location (probably Bibra Lake) and transferring them from his body to beer bottles, collecting about 300 on each hunting trip. The bottles and their contents were sent by rail to Melbourne. He was paid one penny for each leech.[18]

Contemporary confirmation of the commercial importance of leeches in Australia can be found in the *Pharmaceutical Journal* in 1867, which stated that the principal dealer was the Murray River Fishing Company. When conditions for fishing were unfavourable, the fishermen turned to collecting leeches, and from 150,000 to 250,000 could be obtained in a single trip of the company's steamer. They were packed and sent to Melbourne, from which city many were exported to London and Paris where they were highly esteemed. However the main export market was America, where suitable native leeches were rare. They were shipped to San Francisco, Panama and New York, and distributed across the continent from these centres. It was estimated that the company dealt with two to three million leeches a season, and it was believed that the export of these creatures would remain a 'remunerative business for some years'.[19]

Conclusion

The demand for leeches declined during the second half of the nineteenth century, and those required were supplied by wholesalers who bred them in reservoirs that came to be known as leech farms. In the twentieth century they were imported from German leech farms situated near Hanover,[20] and in the 1960s I obtained some from a biological centre in West Sussex. There was a resurgence in demand in the 1980s due to their adoption for use in micro-surgery, and Dr. Roy T. Sawyer purchased this business and founded Biopharm Ltd in Swansea in 1984. Later they moved to Bryngelen Manor, Hendy, and now have subsidiary companies throughout the world and are probably the largest supplier of medicinal leeches.

Acknowledgement

The author wishes to thank Clive and the late Truda Murray for the loan of their copy of *A Treatise on the Medicinal Leech.*

Endnotes and References

1. The definitive work on leeches is Sawyer, R.T. *Leech Biology and Behaviour,* Vols.1-3. Oxford: Clarendon Press, 1986.
2. Baron Georges Cuvier, (1769-1832), a French zoologist who was responsible for introducing the idea that animals should be classified in groups rather than in a continuous series that started with the simplest forms and culminated in man.
3. Carolus Linnaeus (Carl von Linné) (1707-1778) was a Swedish botanist. It was he who introduced the binomial system of nomenclature, each type of plant or animal being given a name composed of two Latin words, the first indicating the genus and the second the species.
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7. Hudson, J., and Son, Reference 5, pp. 81-84.
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9. Brockbank, W. *Ancient Therapeutic Arts,* London: William Heinemann Medical Books, 1954, pp. 93-94.
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From Dioscorides to Derrick Dunlop: developing quality standards of medicines

Dr Michael Jepson

Abstract of the paper given at the joint meeting with the Society of Apothecaries, November 2003, presenting an overview of the historical development of standards intended to raise and ensure the reliability of medicines.

The descriptions of plants and herbs often used as drugs by Pedanios Dioscorides (50-100AD) and earlier writers, gradually included more detail of collection, drying and storage to aid the reliability of effect. The 10th century Saxon manuscript the *Leech Book of Bald* included the names of many herbal remedies and indications for their use.

It was the descriptions of drugs in the early herbals which contributed significantly to advances in the knowledge and use of drugs. The transition to formularies was necessary in order to provide physician and apothecary with information to facilitate the reproducibility of compound drugs for use at different times and in different places. As formulae evolved so was information included about the action of drugs, their use, dosage and frequency. Notably from the time of the printing press in the 15th century herbals published in English, by people such as William Turner, John Gerard and Nicholas Culpeper, contributed to the knowledge of both physician and apothecary and to the development of pharmacopoeias.

Reproducibility was difficult without adequate standards and this problem persisted well into the 19th century. Thus, before the amalgamation of the three regional pharmacopoeias of London, Edinburgh and Ireland took place to create a national *British Pharmacopoeia* in 1864, considerable difficulties and dangers existed. Preparations in the regional pharmacopoeias often bore the same name but could be of varying strengths and prepared by different methods.

Earlier concerns about the quality and reliability of medicinal herbs and spices, their adulteration and substitution resulted in establishing the legal right to garble such merchandise ie to classify and certify them free of adulteration. Initially this right was given to the Grocers' Company in 1456. Subsequently the College of Physicians, the City of London and later the Society of Apothecaries were involved in these controls.

In the 19th century as pharmacopoeias were becoming more scientifically based, the public dangers arising from adulteration of both food and drugs were better recognised and led to agitation. In 1860 an Act for the Preventing of Adulteration of Food and Drink was passed and the first Food and Drugs Act in 1875 made it an offence for drugs to be other than of the quality demanded by a purchaser.

Gradually pharmacopoeial standards were established which required adequate levels of purity, minimal levels of impurities especially of toxic heavy metals, and stability on storage. Reliable and reproducible methods of preparing medicinal products on a small scale were later upgraded by pharmaceutical manufacturers. The compressed tablet provided a dosage form which can reliably disintegrate within a specified time after swallowing and contain a reliable and accurate dosage of as little as 30-40 micrograms.

Since the 1880s pharmacopoeial standards have required products to meet increasingly strict chemical, physical and microbiological stability criteria as well as purity. In 1925 the first Therapeutic Substances Act introduced strict manufacturing and quality controls on a range of biological medicinal products such as vaccines and sera. The Medicines Act of 1968 made it a requirement for all medicines, whether for human or animal use, to be subject to rigorous controls on their safety, quality and efficacy prior to marketing. Quality is the prerequisite upon which safety and efficacy depend. Professor, later Sir Derrick Dunlop for almost 25 years from 1948 made major contributions to issues related to the quality and necessary controls to which all medicinal products are now subject. Associated with the quality of medicines, worldwide problems of adulteration and substitution remain. The challenge continues.

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John Conyers – Apothecary and Archaeologist (c. 1633-1694)

Dr J. Burnby

Conyers the Archaeologist

So far the history of archaeological ideas and practice is not a subject which has commanded much attention. Interest in ancient monuments was already well developed by the latter half of the sixteenth century. Topographers such as Leland, Lambarde and Camden frequently mentioned them, as did the antiquarian Stow, in his famous survey. The middle of the next century saw the establishment of the discipline of field archaeology, the credit usually being awarded to John Aubrey (1626-97). He was undoubtedly a gossip, but he could also be an objective observer and draughtsman, especially in his earlier days. The idea of organised excavation as an all important aid into the past was foreign to him. Digging into barrows and at Stonehenge certainly took place in his day, as it had for many centuries, but this was no more than treasure-hunting. It is possible that the first person in Britain to excavate with the deliberate intention of furthering archaeological enquiry was William Stukeley (1687-1765). A man of imagination, he could and did in his early years make sound observations, but in his latter years he allowed his imagination to run away with him and his later work was marred by imaginative speculation.

Between John Aubrey and William Stukeley there lived John Conyers (c. 1633–1694), citizen and apothecary of London who has a strong claim to the interest of the student of archaeological history.[1] Amongst the Sloane manuscripts are his memoranda written in a crabbed and difficult hand from which it can be seen that he was keenly interested in the newly developing sciences. His first love, because they are his first entries, seems to have been antiquarian, to which he brought an educated and enquiring mind.[2,3]

The apothecary's shop was in Fleet Street and it was his habit to walk up Ludgate Hill in order to see how the re-building of St Paul's Cathedral was proceeding. On 20 August 1675 he wrote 'that this month at severall dayes the labourers at the East End of St Pauls … was forced to digg in som(e) places neare 5 or 6 & twenty foot or so deep'.[4] John Conyers was fascinated by all he saw and being an avid collector of 'curiosities' persuaded the diggers to part with many choice specimens for his museum, '& amongst the rest great Pinns made of bone & Ivory … of these a large sort fell to my share as many as a pint pott would hold.'[5]

Conyers was far more than just an acquisitive and thoughtless collector. He described his treasures carefully, compared them with those of other antiquarians such as Elias Ashmole, and what was more understood the importance of the association of finds.

> Now below the said flint pavements ... was found a foot of Redd earthen Pottsheards the Pott as redd and firme as sealinge wax ... all of w(hi)ch appears to bee of the old Romans use in Brittania & their broken potts for I have severall brassen Coins that was found with these all of the Romans & non(e) other.

Nor was he prepared to take discoveries at their unquestioned face value. He went to watch the labourers making 'The new cutt of Fleet ditch ... verry deep between the fleet gate & the bridg(e) at Holbourne & there next the clay or yellow sand 15 foot d(eep) … was taken up of this red earthen ware cuppe.[6] At the same time the men told him of some small kilns which had been found, '& these had a funnel to convey smoake w(hi)ch might serve for glass forneses for though not anny potts with glass in it whole in the furnaces was there found yet broken Crucibells or Vesls for molteing of glasses together with boltered glasses ... was there found but not plenty.[7]

We have it on no less an authority than Robert Hooke that Conyers museum was an attraction to the lovers of 'curiosities'. John Bagford, writing in the early eighteenth century, said that Conyers had found and kept a pointed piece of flint which had been unearthed in the gravels near Gray's Inn Lane close to some elephant bones. Bagford's illustration of this 'British weapon made of flint lance like unto the head of a spear' shows it to have been an Acheulean hand-axe. It would seem very likely that Conyers had recognised it as being an artefact, although wildly out in his dating.[8]

His greatest discovery however was the value of stratigraphy. Whilst watching the labourers at their work, he noticed that the soil changed colour at different depths, and his observant eye saw at the east end of St Paul's at a depth of fifteen feet what must have been the remains of a mosaic. He compared it with the work on 'St Edward the Confessours monument at West minster w(hi)ch tells me this laying so low & the Roman pott 6 or 8 or 10 foot deeper that as tyme passed awaye I might see the Epochs or beginnings of things & in these various heighths of ground point & show w(i)th my finger the Romans concernes lay deepest then higher those of more recent or fresher concerne.[9] A most telling observation, especially for a man of that time.

We can only speculate what further contributions John Conyers would have made to archaeology if his interests had not then been diverted to physics. In this subject, despite strenuous efforts, he made little mark, though his deal-board hygroscopes interested both his near neighbour, Thomas Tompion (1638-1713) the clock maker, and John Flamstead (1649-1719) the astronomer.

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Conyers the Man

He tells us in his notes that his parents, Edward Conyers and Jane Clarke, were married in 1631 or 1632 in the little church of St Faith's which lay under the ruins of St Paul's. John, the eldest son, was apprenticed to Robert Phelps, citizen and apothecary, for eight years from 29 September 1649. Both his brothers were also to become members of London livery companies. Edward was made Free of the Leathersellers in May 1667, and Emanuel of the Grocers in 1664 as a confectioner.

The occupation of Edward Conyers II is not known though he is thought to have been a merchant. He was descendant of an armigerous family, that of Wakerley in Northamptonshire; although his marriage to Jane Clarke took place in London, he had returned to the Midlands, to Leicestershire, by the time of John's apprenticeship. This branch of the family were almost certainly of Puritanical leanings, and so supporters of Parliament, because of their extremely biblical Christian names such as Noah, Moses and Joshua.

John gained his Freedom of the Society of Apothecaries on 25 February 1658. He rose to no great eminence in his Company but seems to have attained middling rank. First of all he had a pharmacy in Fleet Street near Shoe Lane at the sign of the 'Unicorn' where he stayed all through the Great Plague of 1665-6. In February of the following year he married Mary Glisson, the niece of the great Francis Glisson, Regius Professor of Physick at Cambridge (c. 1597-1677). Daniel Whistler was the first to describe rickets in 1645 in a thesis for his M.D., but Francis Glisson's classic treatise *Tractatus de rachitide sive morbo puerilii* was published in 1650. As was usual John Conyers and Mary had a large family of at least ten children, but only succeeded in rearing two daughters.

It is almost certain that John Conyers lost his pharmacy in Shoe Lane in the Great Fire for when we next hear of him he is at the Sign of the White Lion, also in Fleet Street. It was here that he carried out his time-consuming experiments. His thermoscopes and hygroscopes were placed all over his house and shop, and readings noted carefully with the aid of a horn lantern far into the night then laboriously entered up in his memoranda. His devotion to scientific duty was admirable. He was from time to time a guest of the Royal Society and it was there he demonstrated his pump for raising water and a speaking trumpet. He often propounded mathematical problems. He greatly admired Jonathan Goddard of Gresham College whose lectures he sometimes attended (1617-1675). Goddard was one of the founders of the Royal Society as well as being active amongst the Chemical Physicians.

Unlike his brother, Edward, it is doubtful if John Conyers ever made much money. Edward, one of His Majesty's store keepers at the Tower of London, was hopeful of returning to his family's origins and becoming a country gentleman. In the 1680s he bought a thousand-acre estate at Blaston near Market Harborough, Leicestershire. Edward and his wife Sarah, daughter of Edward Bateman a fellow citizen and member of the Leathersellers, had just the one child, a daughter named after her mother. A marriage was arranged between her and a Baldwin Conyers who was no relation. Alas for his hopes of founding a dynasty, Edward's daughter died after only eight months of marriage. This tragedy was quickly followed by his wife's death the following year. After a brief second marriage of six weeks, his own death occurred in 1701.

Edward had outlived both his brothers, John dying in 1694 and Emanuel in 1690, so that Edward's valuable landed property passed to Emanuel's son, John, who had been born in the parish of All Hallows Staining, London in 1684. Even if the apothecary had succeeded to the estate, it is doubtful if he would have ever willingly left the capital for the relative isolation of a small Leicestershire village. There was no Tompion to show his hygroscope, no Royal Society where he could happily join in the erudite conversation, no excavations to watch, and above all, how many would have made the difficult journey to view his museum and collection of 'curiosities'?

As an epitaph one can do no better than quote from Professor Atkinson 'I believe that our concepts and techniques of today can be evaluated only if we know and understand the roots from which they have grown. In a very real sense, therefore, British archaeology owes its present high standards to the work of its pioneers, at least as far back as the seventeenth century.'[10]

Endnotes and References

1. There is some doubt as to John Conyers' exact date of birth and baptism because they would have been found in the register of St Faith's church which no longer exists, being under St Paul's Cathedral.
2. Sloane MS. 958, v & r. The whole manuscript has now been transcribed but others also exist amongst the Sloane manuscripts.
3. On 2 August 1649 John Conyers was found to have a sufficient educational standard and was bound to Robert Phelps, citizen and apothecary. In February 1658 he gained his Freedom of the Society. He set up in practice first of all on the corner of Shoe Lane, at the sign of the Unicorn, and later moved to the north side of Fleet Street. It is not thought that he became involved in medical practice.
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5. Ibid. f. 109r.
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10. *From Antiquary to Archaeologist. A biography of William Cunnington.* Princes Risborough: Shire Publications, 1975. Introduction, p.xi.

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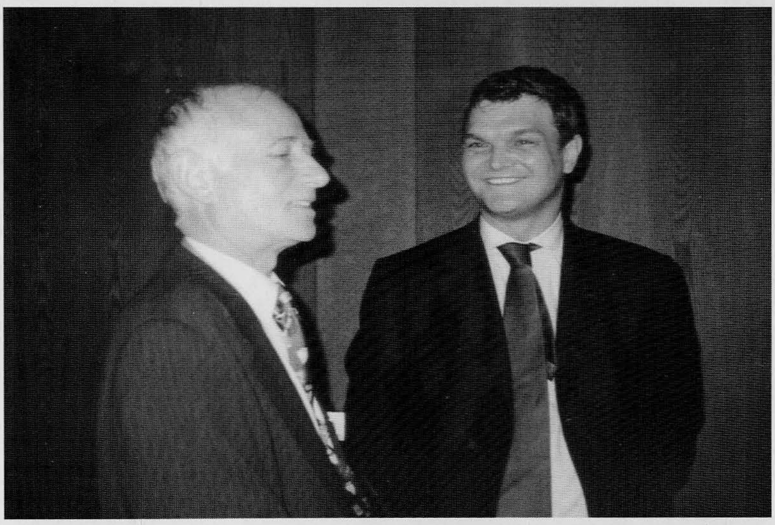
Dr Michael Jepson, speaker at a joint meeting with the Society of Apothecaries on 'From Dioscorides to Derek Dunlop: developing quality standards for medicines' (see p. 14 for abstract)



Stuart Anderson with Kevin Brown, Curator of the Alexander Fleming Laboratory Museum, Paddington, who spoke on the history of penicillin at the February 2004 meeting

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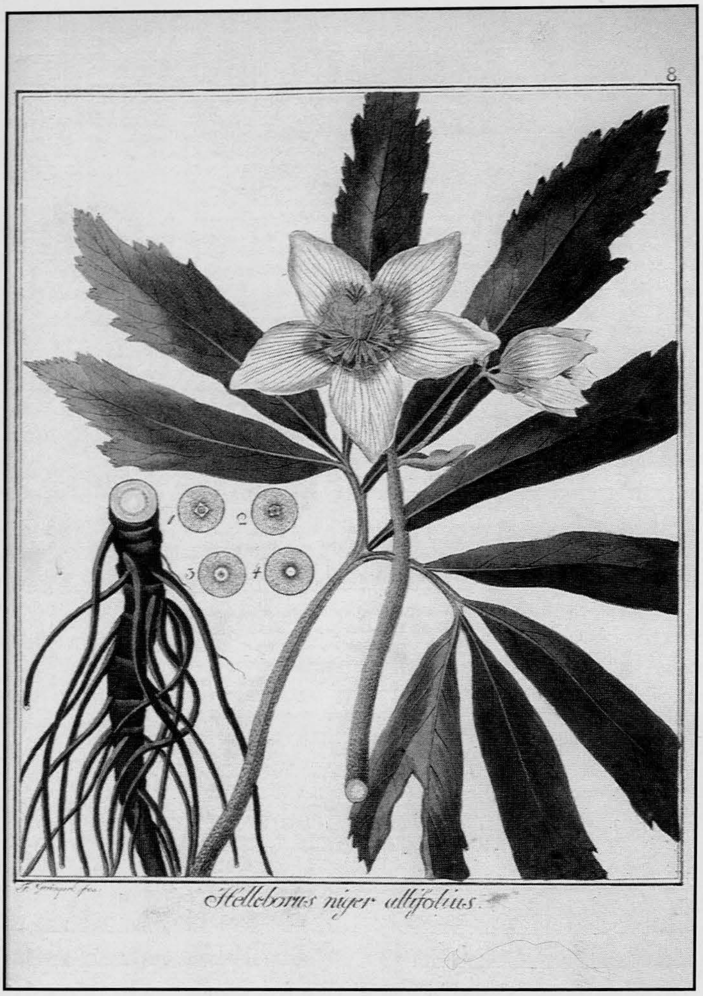

Postcards and greetings cards from the Museum

One of the range of 24 postcards and 4 greetings cards on sale on behalf of the Museum from the Library issue desk at 1 Lambeth High Street. All the cards show images or objects from the Museum's fine collections.
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Left: *Helleborus niger altifolius,* the Christmas rose. Illustration by German botanist Friedrich Haynes, 1825.

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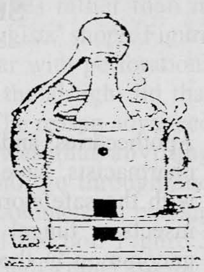

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The Account Books of Thomas Wright Tonge (1773–1854), a Lincolnshire surgeon and apothecary

Dr J. Burnby

Thomas Wright Tonge moved several times in his life, from Gainsborough where he was born, to Louth, and finally to Alford. He has left to us two small account books which are to be found in the Lincolnshire Record Office.[1] From them one can glean some interesting pharmaceutical material from the business run by an apothecary and surgeon in the last decade of the eighteenth century. It is not often that one has a glimpse of the day to day activities of such a man's work.

The first entry shows that he bought a pound of sugar for 9d and a bottle for 6d on the 14th May 1790, and this was followed by a glass inkstand for 4d, half a gross of corks and more sugar, which this time cost him ls 3d. The carriage of goods was always a considerable outlay as he had them from what were then relatively speaking far-distant places, such as Hull, Brigg and York. Occasionally, he also had to pay for letters from Dudley or Irby. One assumes that these were orders for him, bearing in mind that it was the recipient in those days who had to bear the cost of postage.

He had by way of working equipment a funnel, a dram glass which cost him 3d, a sieve, another gross of corks at 3d, a brush (ls 6d), a number of galley-pots from time to time, strainers, bladders, a paper bag which was the high price of ls 2d, though possibly it referred to more than one. He also seems to have used shot for counter-balancing as he several times refers to it.

There were certain disasters for which he had to pay, such as giving the Pinder a shilling, probably because his horse had strayed. Then he had the outlay of a pane of glass, and what was worse, the mending of windows which came to three shillings. He also mended trusses, for which he charged 5d, including the price of the leather. The local people also collected materials for him, such as Elder leaves, which cost him 6d in July 1791, Violets in the April of 1793, Solomon's Seal roots (3d), Oak bark (2d) and the gathering of Hemlock (2d).

Other drugs, certainly not those grown in the English countryside, were all used by him, and included Sarsaparilla, Lignum Guaiacum, the one nutmeg which cost 3d, Ol. Origanum, Gum Arabic, Black Pepper, Balsam of Sulphur, Sassafras, Vin. Ipecac, Bark (one assumes this to have been Cinchona Bark), Oil of Almonds, and Tamarinds. Also included in his list was Spanish Juice [liquorice], which may have come from no further away than Pontefract in spite of its name. These would all have been supplied by the druggists of the nearby towns. Nor should it be forgotten that each year he paid a licence fee of

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Storing Leeches

W.A. Jackson

Apothecaries, and later chemists and druggists and pharmacists, have always had problems associated with the safe storage of their stock. Infestation by insects or fungal infection of plant drugs was not uncommon in the past. High temperatures, damp, light and adulteration could all affect items adversely whether they were animal, vegetable or mineral in origin. Chemicals that were deliquescent, efflorescent or volatile presented special difficulties, but leeches, because they were living organisms, were certainly more troublesome than most. They needed moisture and an adequate supply of air, and displayed a marked tendency to escape. Some years ago I had six of them at home in a toffee jar containing water and covered with eight layers of gauze secured by a strong elastic band. Overnight three forced their way through the gauze and disappeared. Two were found in the dining room within twenty-four hours but it was two weeks before the third was discovered reclining on the turntable of a music centre, apparently none the worse for its excursion. In the following article I hope to show some of the ways in which the difficulties of storing these creatures were surmounted.

Importers and Wholesalers

During the first half of the nineteenth century in Britain the supply of the native medicinal leech, *Hirudo medicinalis*, dwindled to virtually nothing. This was largely due to over-collection so that no breeding stocks were left and to the drainage of the marshlands where they lived. This meant that they had to be imported, the importers also acting as wholesalers.[1]

One such firm was John Hudson and Son of Hull, an important seaport on the estuary of the river Humber – an excellent distribution centre linked to the network of inland waterways. Hudson observed in a tract of 1841 that by this time the English leech, which he believed to be the best for medicinal use, was almost extinct.

Obviously it was necessary to maintain the leeches in a healthy state until they could be sold, and if possible to increase their stock by breeding. They were held in reservoirs with beds of clay and muddy bottoms, eight feet by twenty feet [2.4 x 6.1 m] with a depth of three feet [1 m], connected to each other by gutters and pipes. These had mossy embankments about one foot [0.3 m] deep, in which the leeches could deposit their ova in the breeding season, and were grouped around a fountain that supplied them with fresh spring water. This was very cold, and the imported leeches were deposited into it immediately on arrival. It was found that those that were sick due to the uncongenial conditions in which they had been transported, usually recovered quickly, cleaning off the mucus on their bodies by squeezing through apertures that were designed for this purpose. It was usually said that the water should be kept at a moderate temperature, but the Hudsons found that the colder it was the better the leeches thrived. In fact, sometimes they sent them out in a block of ice, and they were found to be in the best of health when thawed out, though exposing them to frost under dry conditions usually had fatal results.[2] The illustration (Figure 1) that accompanied this description[3] showed a number of rectangular reservoirs enclosed by a moat that was spanned by a stone bridge. The presence of a guard dog with its kennel is an indication that some leech gatherers may have preferred to look for their quarry where they were kept in bulk rather than in the marshes and streams of the area.

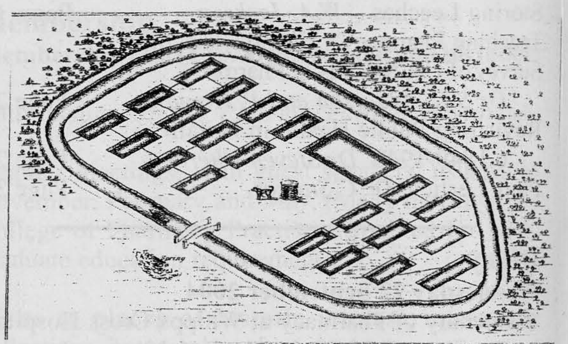

Figure 1. From *A Treatise on the Medicinal Leech*, Reference 2, p. 80

A French pharmacist, Monsieur Charpentier, observed that in the past supplies of leeches had been obtained from different regions where they were held in small reservoirs, especially in the north of France where these had been and still were conical pits twenty to thirty feet [6.1-9 m] wide and eight to ten feet [2.4-3 m] deep. Following the development of the doctrine proposed by the celebrated Professor Broussais[4] a new and extensive type of trade (in leeches) was exploited, partially by Parisian herbalists who constructed reservoirs to hold hundreds of thousands of them. Not every type of ground was suitable for establishing such reservoirs. It should consist of peat or clay and be near a river or a fountain These reservoirs should, if possible, be square or rectangular, twelve feet wide by twenty-four feet long and three feet deep [3.6 x 7.3 x 1 m]. This width was the most convenient though the length could be longer if the ground permitted. The depth could also vary but should be a minimum of one and a half feet [0.46 m]. If the ground was clayey some earth should be used to ensure that the bottom was sufficiently muddy for the leeches to be able to burrow in it.[5]

The Pharmaceutical Journal published a letter on leeches from Mr James Baynes who had worked for several years for the 'largest importer of leeches in England'. Unfortunately he did not give the name of this employer, but offered some observations that he hoped would be useful to retailers. The leeches were

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usually sent out packed in kegs or bags, and on receipt should be emptied into a jar and covered with two or three inches [5-7.5 cm]of water. After a few hours more water should be added and the leeches stirred briskly with the hand or a small whisk to clean them, and then transferred to a jar that was about one third filled with moderately soft water. This should be changed every other day in summer and twice a week in winter. Each time this was done the leeches should be scrubbed with a whisk made from fine broom or willow. If they were to be kept for a considerable time they should be kept in jars containing a rather thick mixture of clay and water. They should be stored in a dark place as strong light appeared to make them uneasy, and the best type of jar was that made from brown stoneware with a rough interior. A jar of two-gallon [9 L] size, one-third filled with water, could hold two hundred and fifty leeches.[6]

After a decline in their medicinal use, they are once more being employed, nowadays to help to prevent blood clots that hinder the healing process in microsurgery. The hospitals obtain them from leech farms. Probably the largest of these suppliers is Biopharm, which has a branch in South Wales.

Storage Containers

Brown Stoneware Jars

In December 1843 Mr. C.F. Buckle of Peterborough wrote to *The Pharmaceutical Journal* describing his 'improved leech conservatories', together with a sketch illustrating them. Figure 2 showed a jar with a capacity of four gallons [18 L] that was perforated from the top to within four inches of the bottom, and

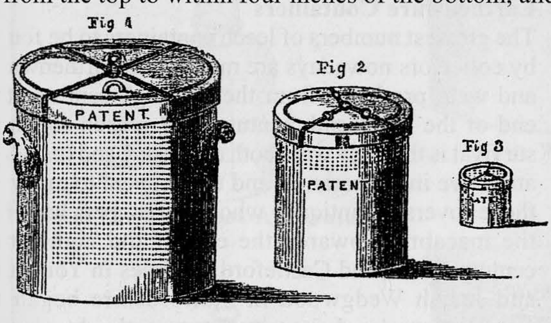

Figure 2. Buckle's Patent Leech Conservatory, Reference 7, p. 395.

with a lid that was ground to fit tightly. This was secured by two iron clamps that could be padlocked if desired. The bottom contained a layer of pea-sized pebbles, and Buckle observed that the leeches were frequently to be found under these, particularly in cold weather. The lower part of the jar was kept immersed in water, preferably in a stream if there was a convenient one. Some idea of the difficulty of storing leeches can be gathered by the fact that he congratulated himself on the fact that not more than an average of one or two died each week in summer, and losses were rare in the cooler months. I imagine that jars of this size would probably have been used by wholesale suppliers of leeches rather than in pharmacies and chemist and druggists' shops. Figure 2 was of a one-gallon [4.5 L] jar with perforations round the top, but not through the airtight lid that was secured by an iron clamp. The reason advanced for the lack of perforations was that anything accidentally spilt on it would not go through and injure the leeches. Again, he recommended placing some pebbles in the bottom of the pot. Figure 3 illustrated a jar with a capacity of half a pint [284 mL] that had a perforated lid that was also fitted with an iron clamp. This must have been intended for use in carrying leeches, probably packed in damp moss, for short distances, for example to the home of the patient where they could be applied.[7] A complete set could be bought for eighteen shillings (90p). Individually they were priced at eleven shillings (55p), five shillings and sixpence (27˚p) and two shillings (10p). They were manufactured by Stephen Green of Lambeth and sold by Maw's.[8]

The Wellcome Collection contains two cylindrical stoneware jars impressed 'PATENT LEECH JAR' measuring 25.5 x 21.2 and 11.8 x 10 cm respectively. Near the top of each jar is a thicker band of stoneware perforated with three tiers of vertical slits to allow access of air, and the lids are held securely in place by metal clamps.[9]

Containers in Shops

Some shops kept their leeches in stoneware jars of the type described, but others used glass or earthenware containers.

Glass Containers

In the eighteenth century leeches were stored in bottles partially filled with water, sometimes sweetened with a little sugar, that was changed not less than every three or four days.[10]

By the mid-nineteenth century, globes filled with water containing leeches were observed in the windows of apothecaries' shops by the antiquarian parson Sabine Baring-Gould.[11] There has been some dispute as to whether these globes were actually employed to store leeches, or were just used by members of the public for pet fish, and it is useful to have eye-witness confirmation of their use as leech containers. Possibly the doubts were raised by the 1874 pattern book of glass manufacturers Hodgetts, Richardson and Co. that illustrated globes, both with and without feet labelled 'fish-globe', but made no mention of leeches. They were priced according to their weight, varying from ten pence per pound (less than three gallons without foot) to one shilling and four pence per pound above three gallons with foot.

On the other hand a 1900 catalogue of Legendre & Cie, illustrated a globe (Figure 3) with foot and a cylindrical container without foot labelled 'Bocaux à Sangsues et à Poissons.'[12] They produced eight different sizes ranging from one litre at 90 centimes (footed) and 80 centimes (without foot) to eight litres at 4.75fr. and 4.50fr. respectively.

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LEGENDRE & Cie, 36, rue de Sévigné, Paris. 85

Bocaux à sangsues et à poissons

1436 à 1443

				À pied. fr. c.	Sans pied. fr. c.
1436	Contenance	1 litre.	Pièce.	» 90	» 80
1437	—	2 —	—	1 60	1 50
1438	—	3 —	—	2 25	2 »
1439	—	4 —	—	2 75	2 50
1440	—	5 —	—	3 25	3 »
1441	—	6 —	—	3 75	3 50
1442	—	7 —	—	4 25	4 »
1443	—	8 —	—	4 75	4 50

Figure 3. Glass Jars for Leeches and Fish, Catalogue of Legendre & Cie, 1900.

Of course, a cover of some description would have been necessary to stop the leeches escaping. The globes and jars supplied by both Hodgetts and Richardson and Legendre & Cie were lipped so that material could have been securely tied around their necks, and an illustration in an article by Dr. Anne Mortimer Young contains a photograph showing a nineteenth century footed glass leech jar covered by a cloth with an elasticated edge. It also contains a photograph of a French ceramic jar labelled 'SANGSUES' that contained a perforated inner lining which could be lifted out of the jar.[13]

In an advertisement for 'Aquaria for Fish or Leeches in a Variety of Shapes and Sizes' by Claudet and Houghton's Glass-shade and Window-glass Warehouse the one illustrated had straight sides and no lip, but appeared to have a slip-on cover to prevent the escape of any leeches it contained. Of course any cover would have to allow access of air. Globes, thirteen inches [13 cm] in diameter, suitable for 100 leeches, were priced at thirteen shillings (65p), or seventeen shillings and sixpence (87˚p) if fitted with suitable plants and snails. A larger size, diameter sixteen inches[40 cm], for 200 leeches was sixteen shillings and sixpence (82˚p), or one pound, two shillings and sixpence (£1.12˚p) if supplied complete with plants and snails. Presumably the snails were intended to eat any algae that grew on the inner surface of the aquarium.[14] This type of aquarium was also illustrated on page 125 of the 1882 edition of *Illustrations to Maw's QuarterlyPrice-Current.*

An interesting glass 'PATENTED PERFORATED CAGE LEECH VASE', invented by J. B. Shillcock of Bromley, Kent, was demonstrated in London at a meeting of the Pharmaceutical Society on February 7th 1866. It was cylindrical in shape, with a lid made from perforated zinc, from which a rod was suspended. This supported two discs of zinc or galvanised iron each of which contained a number of holes of varying diameters.[15] The idea was that the leeches could cleanse themselves by squeezing through these holes and could rest on the discs themselves. Lifting the central knob on top of the lid lifted these from the jar so that it could easily be cleaned, and the water changed. The whole apparatus was constructed so that it could easily be taken to pieces and reassembled. An advertisement in *The Pharmaceutical Journal* said that three sizes were available; viz. for 25 leeches, twelve shillings (60p); 50 leeches, fifteen shillings (75p); and 100 leeches, one pound.[16] There is an existing example in the Wellcome Collection of British Glass that is fitted with an earthenware knob, and perforated earthenware plates (instead of zinc or galvanised iron) six cm apart, one of which is impressed with the word 'MINTON'. The design was patented in 1863.[17]

In her autobiography, *Gipsy,* Louise Rose Hovick (1914-70) who became the most famous striptease artiste of the 1930s, Gypsy Rose Lee, mentioned staying at a hotel in St Louis in the 1920s. It was mainly patronised by theatrical performers, and in the basement was a barbershop. A sign in the window read 'LEECHES FOR BLACK EYES'. These were housed in a fish bowl covered by a piece of wire mesh, and all but one looked 'flat and slippery'. That one was 'bloated and darker than the others', an indication that it had been used and then returned to stock.[18]

During the twentieth century many hospitals held a stock of leeches which were kept in aquaria in the dispensaries.

Earthenware Containers

The greatest numbers of leech containers to be found by collectors nowadays are made from earthenware, and were produced from the late eighteenth to the end of the nineteenth century. The reason for their survival is that they were both expensive and (usually) attractive in appearance, and they appeal to many of those lovers of antiques who have a penchant for the macabre. Towards the end of the eighteenth century Leeds and Castleford Potteries in Yorkshire and Josiah Wedgwood in Staffordshire began to manufacture leech jars in the recently developed cream-coloured earthenware. This was a very attractive and lightweight body, but a demand for a whiter material resulted in it being replaced by pearlware in the early nineteenth century. This was heavier and more robust, and can be distinguished from later earthenwares by its bluish cast. Later, jars were made by a number of factories in white earthenware in various shapes, and examples can be seen in a number of museums, including that of the Royal Pharmaceutical Society of Great Britain, and in the Wellcome Collection.[19]

Many of these jars were elaborately moulded and decorated using gilding and coloured enamels and, later, transfer prints. Jars of this type were frequently placed in a prominent position, forming a focal point

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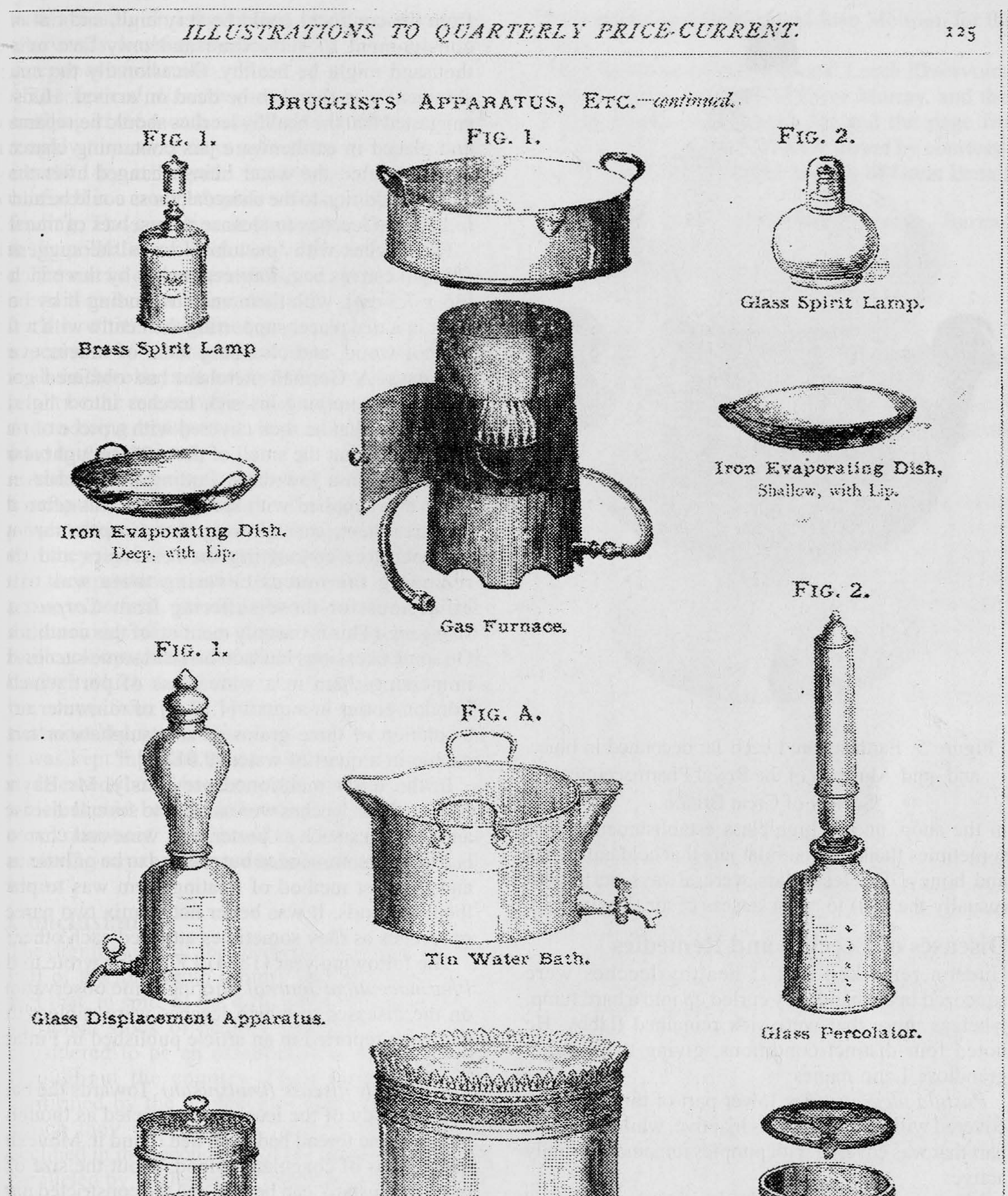

Figure 4. Illustrations to *Maw's Quarterly Price-Current* 1882, showing Shilcock's Patent Perforated Leech Jars, a glass Leech Aquarium and Buckle's Leech Conservator

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Figure 5. Earthenware Leech Jar decorated in blue and gold. Museum of the Royal Pharmaceutical Society of Great Britain.

in the shop, and in high-class establishments were sometimes flanked by similar jars that held tamarinds and honey. The leech jars were always perforated (usually the lids) to allow access of air (Figure 5).

Diseases of Leeches and Remedies

Hudson remarked that if healthy leeches were squeezed in the hand they curled up into a hard lump, whereas those that were sick remained flabby. He noted four distinct conditions, giving them rather grandiose Latin names:

Pustula ulcerata The lower part of the body was covered with ulcers and was inactive, while the upper part that was covered with pimples remained partially active.

Morbus vorans Sometimes, discoloration and frothing of the water in which they are kept and irritability on the part of the leeches could be followed by savage attacks upon each other, often resulting in infection followed by death.

Convulsio paralysis The leech suddenly stretched until it was fully extended and died, its appearance after death resembling a dried stick. This condition was one that was very difficult to control.

Consumptio vulgaris Here the whole body became flaccid except for the lips which remained hard and swollen. If neglected this often proved fatal.

The mortality that resulted from importing leeches from the continent could be very high, and out of a consignment of sixty thousand only five or six thousand might be healthy. Occasionally the entire shipment was found to be dead on arrival. Hudson suggested that the healthy leeches should be separated and placed in earthenware jars containing charcoal and rainwater, the water being changed after three days. In addition to the charcoal, moss could be added to help the leeches to cleanse themselves of mucus.

For leeches with 'pustula ulcerata' he suggested filling a canvas bag, fourteen inches by three inches [35 x 7.5 cm], with them and suspending it by both ends in a dry place, supporting the centre with a flat strip of wood, and cleansing them of mucus every few days. A German merchant had obtained good results by emptying his sick leeches into a hole in the ground that he then covered with a piece of turf. He claimed that the smell of the earth brought about a cure within a few days. Putting the leeches into reservoirs supplied with spring water was often the best treatment, and allowing them to pass through the apertures connecting the reservoirs and thus removing the mucus covering them was often efficacious for those suffering from *Corpuscula stringens*. (This is the only mention of this condition.) On some occasions Hudson had had some success by immersing them in a wine glass of port wine or London porter in a quart [1.13 L] of rainwater or in a solution of three grains of zinc sulphate or tartar emetic in a quart of water [0.017%].[20]

In the letter mentioned previously, Mr Baynes observed that leeches were subject to several diseases, and remedies such as porter, port wine and charcoal had been recommended but seemed to be of little use, and the best method of treating them was to place them in ponds. It was better not to mix two parcels of leeches as they sometimes attacked each other.[21]

The following year (1844) J.F. Rabbe wrote to the *Pharmaceutical Journal* offering some observations on the diseases to which leeches were subject that had been reported in an article published in Finland in 1842.

The *knotty disease (knutsjukan)* Towards the back end the body of the leech is constricted as though a piece of fine thread had been tied round it. Moveable hard lumps of coagulated blood, about the size of a grain of mustard, can be felt, and the constricted parts are paralysed. They normally die within one or two days but may be preserved for a little longer by placing them in soft water in which a little sugar has been dissolved. This disease occurs most frequently from April to June.

The *tinged or yellow disease (rott eller gellsjukan)* In this disease first the head and tail and then the whole body swell. This is followed by convulsions and death results in a few hours. One cause was believed to be ammoniacal vapour, and it was thought that this was a common cause of their deaths in chemists' shops. The swelling could be punctured

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with a needle and the tainted blood squeezed out, afterwards washing the leech in a 5% solution of vinegar or tepid milk.

The *buccal disease (muusvullnad)* This is a swelling in the mouth resulting from the leech being roughly torn away from something to which it was attached by its mouth. It also occurs in leeches confined in a cramped space when collected just after feeding. The condition is contagious, probably due to the pollution of the water in which they are held.

The *mucus disease (slemojuhan)* Here the leeches are said to have a 'miserable look' and are covered with a whitish slime that gives the water the appearance of 'a linseed decoction'. They usually die in about three days. It was believed that the condition might be the result of their inability to lay their eggs due to being transported. It usually occurred from June to August.[22]

Although there was a marked difference in the description of the diseases to which leeches were subject there seems to have been a general agreement that they needed to cleanse themselves of the slime that they produced, and if this was prevented it could prove to be fatal. Strong light also seemed to have a deleterious effect on them. This suggests that Shillcock's patent leech vase with its perforated plates through which the leeches could squeeze to remove the slime from their bodies was a more suitable container than the earthenware jars, providing that it was kept in a dark place. Leeches that were dead or diseased should be removed from the healthy ones which should be held in batches of thirty to fifty in clean rainwater. This should be changed frequently, removing any that were seen to be dead or sick each time.

Conclusion

The significance of the medicinal leech in the first half of the nineteenth century was indicated by the fact that, in spite of the difficulties of maintaining a sufficient stock of healthy specimens, they were considered to be an essential item in pharmacies throughout the country. Their importance was confirmed by the opulence of many of the jars in which they were housed. Their therapeutic use declined in the second half of the century, and this is paralleled by the lessening importance of leech jars, demonstrated by wholesale chemists' catalogues. During the twentieth century leeches were usually only found in aquaria in hospital dispensaries, or in barbers' shops, where there was still some call for their services in reducing the discoloration of bruises, particularly black eyes. There is now an increasing demand for them due to their use in microsurgery, but it seems unlikely that they will be kept anywhere except in leech farms or hospitals.

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The illustration of the Hudsons' Leech Reservoirs is reproduced by courtesy of Clive Murray, and those of the Earthenware Leech Jar and the page from Maw's 1882 *Quarterly Price-Current* by courtesy of the Royal Pharmaceutical Society of Great Britain.

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Teaching Pharmacy's History: The 2003 Survey of UK Schools of Pharmacy

Stuart Anderson and Peter Homan

Since its foundation the British Society for the History of Pharmacy has had as one of its aims the 'advancement of knowledge and propagation of understanding of the history of pharmacy'. Promoting the teaching of the history of pharmacy to undergraduates in Schools of Pharmacy has always been one of the ways of achieving this. Over the years a number of members of the BSHP have been asked to give lectures at Schools of Pharmacy, sometimes as part of a series of such lectures or a course.

Our impression has always been that such teaching is very limited in both scope and content, but until now no comprehensive survey of the situation has been carried out. However, in 2003 a survey of all countries was instigated by the president of the International Society for the History of Pharmacy, professor François Ledermann, and carried out by professor Olivier Lafont from Rouen, France. The survey for Great Britain, North America and Oceania was conducted by Geoff Miller from Australia.

The results of the international survey, to which a total of fifty-six universities responded, were discussed at the international congress for the history of pharmacy held in Sinaia, Romania in 2004. A brief summary of this discussion appears in Newsletter 5 (2004) of the International Society for the History of Pharmacy. Sixteen of those responses were from UK Schools of Pharmacy, and these have been considered separately. A summary of the results has now been sent to the Schools. This report presents further details and analysis.

The main results of the survey are summarised in Table 1. Overall, the teaching of the history of pharmacy in UK Schools of Pharmacy is extremely limited. Two major reasons are given for this state of affairs. Firstly, there is no requirement to do so in the model curriculum of the Royal Pharmaceutical Society of Great Britain; and secondly, those Schools of Pharmacy that are sympathetic to the idea highlight practical problems such as a lack of staff with the knowledge or indeed interest in this area.

Of the sixteen Schools of Pharmacy that returned completed questionnaires, four indicated that no history of pharmacy at all was taught. Of the others, six indicated that history of pharmacy teaching consisted of no more than two hours in a four-year master's degree course. Two provided three hours of such teaching.

Only two Schools of Pharmacy (Liverpool and Portsmouth) offered history of pharmacy as an optional module. In the case of Portsmouth this was a course of 100 hours total learning time. Cardiff has a compulsory course that includes ten hours of history of pharmacy. For two Schools of Pharmacy (Liverpool and Strathclyde) the number of hours was not available.

One of the survey questions asked whether it was possible for students to prepare a thesis in the history of pharmacy in the School of Pharmacy, and if so, whether it was possible at the undergraduate or postgraduate levels. Seven Schools indicated that this was not possible, with an eighth indicating that it was unlikely. Four indicated that it was possible at undergraduate level only, whilst three indicated that it was possible only at postgraduate level (one through the university's department of history). Only one School of Pharmacy (Liverpool) indicated that it was possible at both undergraduate and postgraduate levels.

Respondents were given the opportunity to add comments of their own. These are listed in Table 2.

They present a common picture of Schools of Pharmacy under pressure to fulfil an overcrowded syllabus. It is clear that no change will occur until such time as there is a formal requirement to teach the history of pharmacy. It is clear also that finding staff to teach such a course would present many Schools with a problem. A book providing the basis of such a course would therefore seem to be an essential prerequisite. Despite these difficulties it remains problematical that some Schools of Pharmacy seem able to find up to ten hours during the course of a four year degree for teaching the history of pharmacy whilst others are not.

All this is in marked contrast to that in medicine. The history of medicine is now taught in all UK medical schools. The catalyst for this development was publication of *Tomorrow's Doctors* by the General Medical Council in December 1993, which proposed a major redirection of undergraduate medical education. The Standing Committee on Postgraduate Medical Education (SCOPME) advocated similar objectives for continuing education and professional development as early as 1994. Most medical schools now have staff dedicated to teaching the history of medicine, and a number offer students the option of an intercalated degree in the subject.

Pharmacy has missed a number of important opportunities to correct this omission. The indicative syllabus for pharmacy degrees was published in 1996, and it was this that set out the framework for the content of the four year degree. It is indeed a crowded syllabus, with an emphasis quite correctly on the science underpinning pharmacy and the application of clinical pharmacy skills. Yet it is difficult to see how 'improvement and development of pharmacy' can be understood in the absence of knowledge about developments in the past, or how 'new roles for the pharmacist in health care' can be developed without a clear understanding of the pharmacist's role in the past.

As Schools of Pharmacy move to more joint teaching with other groups of health professionals the case for a more inclusive history of medicine and health care, of which history of pharmacy is a part, becomes compelling, if only to indicate how the different health

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Table 1: Compilation of Results from UK Universities

Question University	1	2	3	4	5	6	7
Aberdeen	-	-	-	-	-	-	No
Bath	No	-	2 hr	Contact	1st year	Role of the pharmacist	No
Belfast	-	-	-	-	-	-	No
Bradford	-	-	-	-	-	-	No
Brighton	Yes	Exam	1 hr	Contact	1st year	Introduction to pharmacy practice	Yes, at under graduate level
Cardiff	Yes	Exam	10 hrs	Contact	1st yr	-	Yes, at under-graduate level
East Anglia	No	-	2 hr	1hr contact+ 1hr self study	1st yr	Major landmarks in development of profession	Yes, at post-graduate level (school of history)
Leicester	No	-	1 hr	Contact	1st yr	-	No
Liverpool	Yes + No	Exam+ Project	n/a	Contact	1st & 2nd year	None	Yes, at both under- and post-graduate levels
London Kings	Yes	Exam	2 hr	Contact	1st yr	-	Yes, at under-graduate level
London Square	Yes	Exam	3 hr	Contact	2nd & 3rd years	Part of Law & Practice qualifying course	Yes, at under-graduate level
Manchester	-	-	-	-	-	-	No
Nottingham	Yes	Exam	1 hr	Contact hours	3rd year	None	No
Portsmouth	Yes	Project report	100 hrs	24 contact + 76 self study	1st year	Development of pharmacy in UK	Yes, at post-graduate level
Strathclyde	Yes	Exam	-	Dispersed in main course	2nd, 3rd and 4th years	-	Unlikely
Sunderland	No	-	3 hrs	Contact	1st & 4th year	-	Yes, at post-graduate level

Questions:

1 Is the course formally assessed?
2 If so, is this by examination or project report?
3 How many hours are devoted to the history of pharmacy?
4 How many of these are contact hours or self-directed learning?
5 When in the curriculum does this course take place?
6 Does the course have a particular theme?
7 Is it possible for students to prepare a thesis in the history of pharmacy in your institution?

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professions have come about and how the boundaries between them have come to be defined.

It is difficult not to conclude that an important element in the teaching of pharmacy is currently being missed in most Schools of Pharmacy. The practice of pharmacy today is complex enough without students having to grasp that complexity in an historical void. They are expected to do so in the absence of any understanding of the political processes and technological developments that have shaped pharmacy over many centuries. Only through a knowledge of the history of pharmacy can students hope to understand how and why pharmacy is practised the way it is today, and why it differs in many ways between one country and another.

Table 2. Additional comments

School of Pharmacy	Comment
ABERDEEN:	Not relevant to today's packed curriculum
BATH:	Considered that there would be more support for a history of pharmacy course by visiting lecturers.
BELFAST:	There are increasing demands for teaching clinical and professional aspects of pharmacy (e.g. supplementary prescribing) in addition to scientific content. Whilst history is important, it is not considered an essential part of the M.Pharm. degree.
BRADFORD:	Time limitations due to new courses being implemented and updating courses that already exist.
BRIGHTON:	None
CARDIFF:	Need to find a lecturer with an interest who can teach pharmacy history.
EAST ANGLIA:	Guest lecturers are being considered and over next five years time devoted to history could increase.
LEICESTER:	None
LIVERPOOL:	None
LONDON–KING'S:	Considered insufficient space in their course for history, also most students don't appreciate its relevance.
LONDON–SQUARE:	None
MANCHESTER:	No space in an already crowded syllabus. Not included in RPSGB indicative syllabus.
NOTTINGHAM:	Only taught within law course, development of the pharmacy profession.
PORTSMOUTH:	Indicate that their course will be ended in the next 5 years.
STRATHCLYDE:	There is no formal 'course'. The topic is fully integrated into the M.Pharm. teaching programme.
SUNDERLAND:	Due to a full curriculum history of pharmacy is considered part of pharmacy prac tice modules and will continue to do so.

Revisiting Public Health in Britain c.1840-1948[1]

Dr Steven Cherry

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The record of this country in its health and medical services is a good one…. Achievements before the war - in lower mortality rates, in the gradual decline of many of the more serious diseases, in safer motherhood and healthier childhood…all substantiate it. White Paper, 1944, *A National Health Service* (Cmd 6502).

Few people would deny that medical knowledge and public sanitation, formal health care systems and the management of illness and disease improved in peacetime Britain in the century to c.1950. Most would also recognise that the associated benefits were inequitably distributed however, and linked with features such as social class background, gender, age and geographic area. There is ample evidence of declining death rates over the period with rather less on recorded patterns of disease. However, the avoidance of death and information on causes of mortality are a poor guide to the experiences of more routine illnesses and still less for health levels. In 1946 the World Health Organization defined health as 'a state of complete physical, mental and social well-being, not merely the absence of disease or infirmity'. As historians, we tend to surmise about health from mortality data or medical constructions of disease rather than from popular experiences, and most people probably just considered themselves fortunate to avoid serious illness or incapacity. So there are no statistics and little personalised recording of positive or 'good' physical or mental health as such, and any broader sense of 'feeling well' was likely to encompass lifestyles, social roles and expectations often difficult to express, let alone to quantify.

A discussion of 'public health' should acknowledge the respective contributions of income, nutrition, medical effort and social intervention to health in its wider sense. In the space available here I will focus upon the services that came to be associated with a shared 'public health', rather than one-on-one medicine or hospital medicine and surgery, and I'll begin by suggesting that the operative perceptions of 'public health' have also changed over time.

At our starting point, in the second quarter of the 19th C, the emerging issue is proper sanitation as a response to high death rates, with a particular focus upon dirt. But changing models of disease, influenced by greater medical input, soon led to greater attention being placed upon features such as inoculation and isolation. These were also public services but, along with others such as the inspection of factories, regulation of food supplies and shops etc., they also represented individual safeguards or care. And, with

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growing recognition of wider health issues and gaps in other forms of medical provision, 'public health' became increasingly concerned with the development of personalised services, especially for babies and mothers initially but for others too. In one sense these can be considered as national investments for the benefit of everyone but, as services, they also represent forms of competition with other medical models such as family doctoring or sick clubs and insurance in the health care market. Inevitably this raises ideological issues in public health, with municipal or state health care representing 'the public sector', cf. philanthropic, voluntary or private provision.

Subject to all these 'health warnings', I will examine certain key episodes in the development of public health, particularly changing ideas about disease and the role of medical officers of health and other health professionals. Then I will consider some interpretations of strengths and weaknesses in 'public health' and their implications at the establishment of the state national health service in 1948.

Baldly stated, Britain's public health problems in the form I will discuss today stemmed from population growth and initially unregulated industrialisation and urbanisation. The population, just over 10 millions 1801, virtually doubled to nearly 21 million in 1851 and it almost doubled again, to 41 millions by 1911. This was increasingly also an urban and concentrated population: 1 in 5 people lived in a town or city in 1820 but 4 in 5 by 1900. And the cities outside London were growing into great conurbations: Glasgow, Liverpool, Birmingham and Manchester had a combined population of less than 300,000 in 1801 but well over 2 millions by 1900.

At least until the 1840s, this urban development was based upon not so much the precise 'invisible hand' of the free market as its careless 'invisible elbow'; the laws of chance and cheapness. Shoddy, overcrowded housing, inadequate or polluted water supplies, and defective sanitation came to epitomise early 19th C public health problems. But these were only to be expected in a largely unregulated environment for those who could not afford better amenities, and any alleviation incurred political objections and expense. Historians continue to argue whether poverty, laissez-faire ideology, the underdeveloped structures of local and central government; or inadequate knowledge among various specialists from doctors to sanitary engineers was primarily responsible for this situation, but the combination of these features constituted a formidable obstacle to the public health.

One can find positive or negative aspects in the response to this situation. Positive interpretations focus upon scientific developments and legislation. Disease processes were not fully understood and attempts to register systematically the cause of death did not begin until the 1850s. Aside from questions of God's will or destiny, 'traditional' theories of contagion linked infection and fever with crowding and direct personal contact, or with foul airs, stagnant water and their associated miasmas. But in the second quarter of the 19th C sanitarians began to focus upon dirt as the root cause of disease. Although they still perceived sources of contamination as inert, they suggested that much disease was preventable (e.g. after investigations into typhus in East London in the late 1830s) and that it was economically worthwhile to tackle it. Then Edwin Chadwick's 1842 Sanitary Report and various follow-up local inquiries into the Health of Towns pointed to the need for central government intervention and sanitary engineering.

So this is public health conceived in terms of public sanitation. Permissive legislation, notably the 1848 Public Health Act, then represents a 'breakthrough', that sets precedents, leads to accumulation of interventionist powers and compulsory statutory requirements. Thus a General Board of Health, established with limited powers to order public health improvements, was followed by a succession of laws, eventually consolidated in the Public Health Act of 1875. In effect, this prescribes the public health responsibilities and duties of local authorities, heralding a period of improving provision through to replacement legislation in 1936.

Thus, a former Medical Officer of Health (MoH), William Fraser, writing a *History of Public Health* in the 1960s, saw the late 19th C as a turning point:

> a time during which progress in the provision of a sanitary environment...after the many false starts of the preceding twenty years, now began to accelerate surely and steadily.[2]

But he is acknowledging here that the law could be circumvented, that there would at minimum be time lags between legislative intent and the grassroots delivery of provision, and that other features should be considered.

Less optimistically, it could be noted that ignorance, complacency or a reluctance to intervene had contributed to growing public health problems and were not suddenly swept away by science or legislation. Connections between poverty and poor environments were not too difficult to make. Tuberculosis –'the poor man's disease'– accounted for one-quarter of all 19th C deaths. Typhus and typhoid were not differentiated until 1868 but louse-borne or water-borne infection was testimony to poor domestic conditions; hardly surprising when public hygiene was inadequate. An underrated range of bronchial and industrial diseases carried off still more people, whose deaths at the age of 45 or so were still often attributed to non-specific causes, 'natural causes' or even 'old age'.

Arguably, it required an infrequent but horrific killer such as pandemic cholera, which struck Britain in 1831, 1848, 1854 and 1863, to ram home the need for public health improvement. Cholera affected all

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social classes and could not simply be dismissed as a 'poor man's disease'. With no cure in sight, the need for preventive measures, principally involving engineering to achieve pure water supplies and effective sewerage, became paramount once cholera was identified as a water-borne disease by John Snow in 1854. Yet even then, 'progress' was not assured. Centralising legislation was opposed – a famous *Times* editorial in 1854 stated; 'we prefer to take our chance with cholera and the rest than be bullied into health'. Chadwick was himself dismissed in 1853 and the General Board of Health was stripped of its powers in 1858. And legislative intent was often subverted by local authorities sensitive to the opinions of ratepayers or by vested interests. If bodies such as the Leeds Pig Protection Society could resist efforts by the local MoH to clean up the city, one can speculate upon what landlords, private water companies or railway companies might do.

However, public health as sanitation in response to high death rates, and the association of disease with dirt, began to be re-interpreted under medical influence. In particular, changing perceptions of disease suggested greater attention to inoculation and isolation. Alongside the inspection of factories and food shops etc. these constitute services for 'the public' in the name of public health.

Michael Worboys' new work on *Theories of Disease* suggests that although bacteriology was indeed 'the coming thing' from the 1860s, approaches to it were drawn-out and ambivalent. For example, the first Medical Officer of Health was appointed in Liverpool in 1846 and more were encouraged under the 1848 Act. But there were still only about 50 MosH in the late 1860s and local authorities were not required to appoint one before the early 1870s. However by 1900, there were at least 1,800 MosH. These professionals emerged within a wider sanitary reform movement which involved engineering, chemistry, meteorology, the law etc. and the issue of 'preventable deaths'. On the whole they took a practical approach : they had no uniting theory but, to quote Worboys,

> MosH believed that their 'practice' was 'very far in advance of theory'. They maintained that, despite knowing little or nothing about the intimate nature of disease-poisons, they knew how to reduce their spread, violence and effects.[3]

Note here the 1850s concept of 'disease poisons' or 'zymes'; these were not living matter but they allegedly had properties akin to living cells and included forms of dirt. This wider and revised version of contagionism included 'external' contact (e.g. the flaking skin of smallpox victims, parasites, and diseases caught from animals), and it recognised the importance of quarantine or isolation as well as prevention. In the 1860s there were still concepts of 'disease germs' that were spontaneously or internally generated within the body; and notions concerning an alleged predisposition were still popular in explaining 'external' disease agencies. So it was only later in the 1870s that the focus fell upon external micro-organisms as the agents producing sepsis or infectious etc. disease.[4]

However, if diseases were specific, and attributed to particular micro-organisms, it followed that standardised measures or treatments should now be applied whenever a particular disease was encountered. Hence a growing coherence to 'public health' and one increasingly shaped by its professionals, the MosH. By the late 19th C,

> the day-to- day work of MosH involved both sanitary inspection and disease control. They supervised teams of sanitary inspectors who were responsible for the collection of statistics and for monitoring housing, drains, the water supply, nuisances… and food adulteration.[5]

Evaluation

Let us think in terms of *Evaluation*. Just how effective were these health efforts? Levels of mortality and morbidity are not the best indicators of public health but, in the absence of more positive and reliable indicators, we have to use them. Death rates among adults and older children may have begun to fall from the 1850s, although there was no clear, overall reduction in national CDR until c.1870 (then about 22 per 1000). A longer term decline to a rate of 12 per 1000 or so then followed by 1939, at decelerating rates and with some lags in Scotland. Rural death rates remained lower than urban, but a reducing differential between them suggests urban public health improvement over time. However, there was no pronounced fall in 19th C infant mortality (roughly 150 deaths per 1000 live births in the first year of life) until the early 1900s: a more consistent decline to 60 or so had occurred on the eve of World War II (higher in Scotland). This suggests the eventual success of infant welfare measures, health visiting, vitaminised baby milk and 'micro-sanitation' measures in the domestic sphere, but these cannot be seen simply as the fruition of 19th C public health efforts.

Although overall improvements by the 1930s were all to the good, the persistence of social class variations was noticeable and also revealing. Death rates among men and women in the professional and business classes were roughly one quarter below those among unskilled men and women workers in the 1930s. Infant mortality among unskilled working class families was roughly double that among the upper and middle classes in 1910 and still seventy five per cent higher in the 1930s.[6] We might also add that *maternal* mortality rates actually increased (above 4 per 1000 births and in some areas as high as 10 per 1000) rather than decreased in the 1920s and early 1930s, rather ominously in the classic depressed areas.

Other patterns in the mortality data suggests an epidemiological transition, with fewer deaths from

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infectious diseases and more from the chronic or degenerative illnesses affecting an older population.[7] Significantly, most water-borne and airborne infections were reduced, although TB still affected at least 250,000 people in 1900 and roughly 50,000 annually in the 1930s, with nearly sixty per cent fatality. Instead, heart disease and circulatory conditions accounted for one in four of adult deaths by then, along with the rise of cancer mortality with breast cancer prominent among women and lung cancer among men. But babies were still vulnerable to gastro-intestinal infections until the combination of health visiting, better baby-milk substitutes and improved hygiene began to be reflected in fewer deaths, particularly from diarrhoea.

I said earlier that Morbidity may be a better guide to health than mortality but full national morbidity data was not compiled before 1945 and any earlier evidence may be unreliable. For example, those diseases which required public notification were usually infectious, and hospital records focused in detail only upon the seriously ill. Friendly society, health insurance and GP records (perhaps approximating to primary care?) were skewed towards male family breadwinners who had greatest access to such facilities. Until the state NHI scheme commenced in 1913 there were fewer medical consultations, but probably no less sickness. And unknown but considerable numbers of sick people did not seek medical attention or become patients as such. We should always bear in mind Roy Porter's comment that 'not all sufferers became patients, nor were all healers doctors' in public health, just as in medical history. Many went to the chemists: there had been at least a fourfold rise in the number of chemists and druggists in the late 19th C, with some 40,000 retail outlets by 1900, to say nothing of the explosion of patent medicines by then. By the 1930s an estimated £30 millions was spent annually on patent medicines, the equivalent of 3 per cent of working class household budgets and more than national spending on the voluntary hospitals or the proto-public hospitals.

Those who went to the doctor's reported mainly with bronchitis, throat infections, colds and influenza, which accounted for 35 per cent of all illnesses between the wars.[8] Rheumatism and lumbago, digestive disorders, sepsis, skin conditions and nervous disorders were also prominent. Men were additionally vulnerable to industrial and physical injuries. Women were particularly affected by debility and neuralgia but, with less access to formal health care, much of their poverty and stress-related illnesses went unreported. The potential of fertility control measures in reducing illegitimate births and their attendant risks, or the threat of extra children to women's health, family incomes or overcrowding, also went understated in medicine and social policy. (I would add that, correspondingly, the role of the pharmacist as provider of advice as well as products has been understated here). Contemporary investigations, by the National Birthday Trust in South Wales or by Medical Officers of Health in north-east England, into children's health revealed ominous links between family, low income, poor accommodation and inadequate nutrition. Yet official and medical explanations focused upon maternal or parental neglect. These were no substitute for positive measures; nor did they resolve the grim considerations of cost and likely outcomes of medical treatment that had to be made when children were sick and incomes were insufficient.[9]

I said earlier that the onset of the 19th C decline in mortality is conventionally explained in terms of improved social intervention and public health measures, or rising nutritional levels, or some combination of these. A resultant rise in longevity might not mean more healthy lives, however. There are suggestions of an increased incidence, or at least increased reporting of sickness in the later 19th century and we can reasonably assume that the risks of sickness increased with the ageing of the population structure. So perhaps 19th C public health measures did not prevent people from falling sick. For example, in the battle against dirt, improved sanitation was vital in combating water- and food-borne infection, but it did not prevent continuing exposure to disease. Nevertheless, if falling death rates do not always signify reduced levels of illness, they suggest more recoveries from it, perhaps the results of a better-fed population with greater resistance to illness, or more effective forms of medical management of illness.

Before 1900, factory reforms or measures to reduce atmospheric pollution had little effect, and improvements in occupational health measures before 1939 were patchy, at best.[10] Arguments for better housing and reduced overcrowding are stronger on the eve of World War II, but not earlier. If more recoveries from disease really do suggest more resilient populations, bolstered by better nutrition, then such optimism must be tempered by continuing evidence of considerable poverty, malnutrition and its associated diseases, notably TB, rickets, bronchitis and anaemia.[11]

For a long time the medical contribution to health improvements has been played down, apart from some successes with vaccination and particular surgical procedures. But I have suggested that, aside from one-on-one medical practice, the MosH increasingly shaped public health efforts to contain infectious diseases. Inoculation, beginning with smallpox in the 18th C but accelerating with late 19th C bacteriology and its successes, from diphtheria antitoxin in the 1890s to the BCG/TB vaccination and new breakthroughs with polio, was a 'front line' preventive measure. But from the late 1860s in London and perhaps the 1880s elsewhere, the process of routine isolation complemented it. Putting an infected person into isolation hospital represented an individual service, but this was also a

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community service in the interests of the Public Good. As such, it was offered to everyone and thus meant a breach with the poor law mentality of stigmatised services for specific groups of paupers. In fact, by 1914 local authorities provided one-sixth of all hospital beds in England & Wales and one-third of those in Scotland. I would see this as an indicator of a proto-public sector, and a better one than poor law provision.

I said earlier that more than the simple gestation of 19th C social investment was required to reduce infant mortality levels, because these had barely fallen by 1900. The development of personalised local authority services, sometimes in conjunction with charitable efforts, reflected the combination of individual care with the perceived national interest. Concern with high infant mortality rates was first reflected in legislation covering the training and conduct of qualified midwives in 1902, extending to the encouragement of Local Authority midwifery services in 1918 and their requirement by 1936. Early infant welfare centres (in north London, Sheffield, and Leicester) or health visiting services (Glasgow, Huddersfield) targeted new mothers and 'defective mothering' in the promotion of health awareness and personal hygiene. Volunteers and district nurses might be involved in such work (about 8,000 district nurses in 1930s) although the formal training of health visitors from 1924 created some 6,000 specialists in the 1930s.

Meanwhile legislation in 1907 had required the medical inspection of schoolchildren, particularly with a view to their physical efficiency, although medical attention and a Schools Medical Service followed on by 1919.[12] In the adult population, venereal diseases and tuberculosis were threats even before they were compounded in the Great War, which led to legislation providing new, free public services. The 1917 Venereal Disease Act encouraged local authorities to establish clinics and prohibited the advertising of spurious remedies, though it stopped short of recommending prophylactic measures. This undermined its effectiveness but was an improvement on post-1850s+ Contagious Diseases acts which had targeted prostitutes. Provision for tuberculous patients under the 1921 TB Act included inspection, dispensary and surgical facilities, though the 22,000 sanatorium beds provided by 1935 were never going to be sufficient. At least 250,000 people had advanced forms of TB, with almost 60% fatality levels, and roughly 50,000 still contracted it annually in the 1930s.[13]

To varying degrees these services were seen by established medical practitioners as competition with their preferred model of family doctoring or even as the harbingers of socialised medicine. In fact such measures were welcomed in the national interest in the immediate postwar years by senior figures such as Robert Morant and George Newman at the Board of Education and Sir Arthur Newsholme (then Chief Medical Officer). Like them Lord Rhondda, President of the Local Government Board, favoured the creation of a Ministry of Health in 1919 and a public hospital service of some kind. But, although the range of health facilities improved between the wars, the economic context was often discouraging and governments were reluctant to initiate or fund reform.

This leads me to some alleged failings in public health. Recently Anne Hardy has suggested, following England's record as 'the first Sanitary Nation', a loss of impetus:

> England pioneered mains drainage systems, and the water carriage of wastes, and constant filtered water supplies, and slum clearance. But when it came to the hygienic revolution, which began in Continental Europe and America in the 1870s, she could not sustain the momentum. ... Garden city principles, hygienic provision in schools and public places, veterinary supervision of meat and milk, the adoption of new immunization programmes … which took preventive medicine forward after 1880, were either late in making an impact in England, or failed to make much impact at all.[14]

This approach leads us into some perhaps doubtful territory concerning 'national cultures' in disease prevention. For what some people see as failures others see as virtues: the state reluctance concerning the tight regulation say of meat or milk (possibly under pressure from agricultural lobbies); or traditions of hostility to immunisation programmes (cf. current problems with MMR); or general suspicion of the efforts of health promoters (smoking, alcohol, high-fat high-sugar foodstuffs). The more generalised the analysis, the more 'ideological' it is likely to be.

However, I would offer three illustrations of lost opportunities or failures in public health. A specific issue would be Sir Bernard Dawson's proposals in 1920 to group GP and basic surgery in a network of health centres, as this might have provided the basis for the co-ordination of health care at the local level and a definite basis for arranging referral between what are today considered as levels of primary and secondary care. My second illustration concerns a large group of the population, working class women, who were largely excluded from state health insurance and local authority services. The Ministry of Health insisted in the late 1920s and early 1930s that worrying evidence concerning their health, nutrition and maternal mortality rates did not reflect poverty and the Depression.[15] Sir George Newman, then chief medical officer, privately acknowledged the mass of 'dull diseases' affecting these women but publicly prioritised and endorsed controls on health spending, as he feared that 'the demonstration of a great mass of sickness and impairment attributable to childbirth … would create a demand for organised treatment by the state'.[16] For all the state's focus upon motherhood and infant welfare, the maternal mortality rate actually rose back to its 1900 level of 4.1 per 1000 births in 1935. Of course,

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new drugs against sepsis, implicated in one-third of maternal mortality and in abortion attempts, and blood and plasma transfusions and enhanced midwifery services from 1936 all improved matters, but there was arguably some dereliction of duties here by the guardians of public health.

My third defect concerns provision under the 1929 Local Government Act, which in theory enabled local authorities, already responsible for a splay of health measures, to press on with a public hospital service, possibly but not necessarily in cooperation with the voluntary hospitals. In some scenarios, perhaps the one pursued by the old London County Council, this might have delivered an 'all round' health care system and even a model for a national health service, with provision from street cleansing through to health centres (Finsbury Park) and the teaching hospital (LCC Hammersmith) under local authority control. Instead, the reluctance of some local authorities to sanction appropriate spending and the failure or inability of the Ministry of Health to organise and cajole resulted in most local authorities providing rather unco-ordinated services. In practice, this meant that the local MosH were notionally in charge of services of variable quality and that concepts of 'public health' were couched in terms of lists of services, rather than something thought through and informed by wider notions of 'positive health' or health promotion.

Although I don't have space to consider the establishment of the NHS, I would suggest that, as a result of these limitations, the MosH and local authorities turned up for negotiations about a future national health service just as the politicians, civil servants, doctors, voluntary hospitals and the health insurance industry did: with little in the way of overall concepts to contribute and lots of vested interests to defend. Consequently, despite real gains and achievements over the preceding century, the delivery of public health and the NHS may have been less carefully thought through than was possible.

This paper was presented at the BSHP Annual Spring Conference at Cambridge, April 2004.

Endnotes and References

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2. Fraser, W.

3. Worboys, *M. Spreading Germs: disease theories and medical practice in Britain 1860-1900.* Cambridge: Cambridge University Press, 2002: 38.

4. Notice how these medical breakthroughs appear in reverse order, from results of disease, (in morbid anatomy/pathology to 1850s); through its processes, (physiology to 1870s) and back to its origins bacteriology): contrary to our perception of a fixed course of disease with its beginning, middle, and end in death or recovery).

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11. McGonigle, G.C. and Kirby, *J. Poverty and Public Health.* 1936: 98. Recent work on heights as an indicator of improved nutrition in this period remains less eye-catching than reported social class differences in height and weight.

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15. Kenner, *C. No time for women*, 1985: 35; Webster, C. Healthy or Hungry Thirties? *History Workshop* 1982; 13: 110-29, 122.

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Paul Ehrlich's 150th Birthday

Dr Christiane Staiger

On the occasion of the 150th anniversary of the birth of Paul Ehrlich, a medical scientist known for his pioneering work in haematology, immunology and chemotherapy and for his discovery of the first effective treatment for syphilis, there are several interesting websites available on the Internet.

Paul Ehrlich was born on March 14, 1854 at Strehlen, in Silesia, Germany (now Strzelin, Poland). His parents were Ismar Ehrlich and his wife Rosa Weigert. Ehrlich was educated at the Gymnasium at Breslau and studied at the universities of Breslau, Strasbourg, Freiburg-im-Breisgau and Leipzig. While still a medical student, Ehrlich became interested in dyes and in 1878 he obtained his doctorate of medicine with a dissertation on the theory and practice of staining animal tissues.

He continued his investigations on staining of specific organs, tissues, and cells at the Charité Hospital in Berlin. Ehrlich showed that all the dyes used could be classified as being basic, acid or neutral and they reacted specifically with various components of blood cells and the cells of other tissue. His work on the staining of granules in blood cells laid the foundations for future work on haematology and the staining of tissues. In 1882 Ehrlich published his method of staining the tubercle bacillus that Koch had discovered. He also began to test methylene blue for therapeutic properties to determine whether it could kill pathogenic microbes.

In 1887 he qualified as a Privatdozent (unpaid lecturer or instructor) in the Faculty of Medicine at the

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University of Berlin. In his thesis *Das Sauerstoff-bedürfnis des Organismus* (The Requirement of the Organism for Oxygen), he mentioned for the first time the side-chain, on which he later founded his main theory. Between 1879 and 1883 he published 37 scientific contributions. In 1883 he married Hedwig Pinkus and they had two daughters, Stephanie and Marianne.

A bout of tuberculosis (probably contracted in the laboratory) forced Ehrlich to interrupt his work and to seek a cure in Egypt. He returned to Berlin in 1889 and Robert Koch, Director of the newly established Institute for Infectious Diseases, soon appointed him as one of his assistants; Ehrlich began the immunological studies with which his name will always be associated.

Very little was known about the precise manner in which bacteria cause diseases, and even less was known about the body's defences and about therapeutic effects. The working hypothesis that Ehrlich developed was the side-chain theory. According to this each cell has a vital centre of protein substance and a series of side-chains, or receptors, which absorb and assimilate nutrients and certain toxic substances as well. Only if the 'haptophore' group of a toxic molecule combines with the side-chain of the cell, can the bacterial toxin act upon the cell. The affected organism then produces great quantities of side-chains, all of them 'gauged' to the disease-producing toxic agent. These immune bodies prevent a renewed infection, so that the organism is actively immunised.

Ehrlich developed a way of measuring the effectiveness of serums that was soon adopted for the standardisation of diphtheria serum. On the basis of his achievements Ehrlich continued his career, moved to Frankfurt am Main in 1899 and was made director of the Royal Institute for Experimental Therapy.

Ehrlich now devoted himself to chemotherapy and started experimenting with the identification and synthesis of substances that could kill parasites or inhibit their growth without damaging the organism. The most successful products of this quest were Salvarsan or '606' (1909-10), its chemical name being dihydroxydiaminoarsenobenzene dihydrochloride, and Neosalvarsan (1912), the most effective drugs for treating syphilis until the advent of antibiotics in the 1940s.

Ehrlich had, like so many other discoverers before him, to battle with much opposition before Salvarsan and Neosalvarsan were accepted for the treatment of human syphilis; but ultimately practical experience prevailed and he became famous as one of the main founders of chemotherapy.

Ehrlich was known for his lifelong habit of eating little and smoking incessantly 25 strong cigars a day. He was an ordinary, foreign, corresponding or honorary member of 81 academies and other learned bodies all over the world. He held five honorary doctorates, and was also honoured by Orders in several countries. In 1908 he shared with Élie Metchnikoff the highest scientific distinction, the Nobel Prize, which he recieved to honour his work on immunisation. Having suffered a first stroke in December 1914, Ehrlich succumbed to a second stroke in August of the following year. He died August 20th, 1915 in Bad Homburg and was buried in Frankfurt.

Internet links

Paul Ehrlich: Summary of important Dates
http://www.pei.de/english/infos/epaul.htm
Paul Ehrlich Biography
http://www.nobel.se/medicine/laureates/1908/ehrlich-bio.html
The Nobel Prize in Physiology or Medicine 1908
http://www.nobel.se/medicine/laureates/1908/press.html
Chemical Achievers: Paul Ehrlich
http://www.chemheritage.org/EducationalServices/chemach/ppb/pe.html
Ehrlich, Paul
http://www.britannica.com/nobel/micro/187_19.html
Ehrlich finds cure for syphilis 1909.
http://www.pbs.org/wgbh/aso/databank/entries/dm09sy.html
200 Deutsche Mark banknote with Paul Ehrlich
http://www.bundesbank.de/bargeld/noten/dm/200dm.en.php
http://oenb.ppmedia.at/ezb/changeover/dem/200dem.htm
Paul-Ehrlich-Institut. Federal Agency for Sera and Vaccines
http://www.pei.de
Paul-Ehrlich-Society of Germany
http://www.p-e-g.org/
CVs in German:
Auf 55 x 32,80 mm Gedenken an Paul Ehrlich
http://www.schlesien-bonn.de/aktuell/meldungen/ehrlich.htm
Paul Ehrlich: Mediziner, Serologe, Pharmakologe
http://www.m-ww.de/persoenlichkeiten/ehrlich.html
Paul Ehrlich (1854-1915)
http://www.amuseum.de/medizin/htm/ehrlich.htm
Paul Ehrlich. Definition, Bedeutung, Erklärung im Lexikon
http://www.net-lexikon.de/Paul-Ehrlich.html
Friedrich, Christoph. (in German). Von der Immunologie bis zu Salvarsan. *Pharm Ztg* 2004; 149: 808-812; online at *http://www.pharmazeutische-zeitung.de/pza/2004-11/titel.htm*

The Account Books of Thomas Wright Tonge:
continued from page 17

one shilling in order to have the right to sell perfume.

During the six years he spent in Louth, he paid some £50 to £60 from the till and indeed he has detailed them for us:

Annual Expenses in the Shop

From May 12 1790 to May 1791	£7 11s 4d
From ditto to May 1792	£11 12s 7d
From ditto to May 1793	£14 11s 4d
From ditto to May 15, 1794	£10 12s 6d
From ditto to May 14, 1795	£8 5s 2d
From May 14 1795 to May 14, 1796	£4 3s 0d

Reference

1. Lincolnshire Record Office, call numbers Lamb 1/19 and Lamb 1/20.

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Speakers at the BSHP Spring Conference at Cambridge

Dr Christiane Staiger, speaker on *Pharmacies' Interior Design: the business card of the pharmacy*

Christopher Wragg, speaker on *Pharmacy in literature*

Dr Steven Cherry, Senior lecturer in history at the University of East Anglia, speaker on *Changes in public health during the hundred years up to the NHS* (see p. 26)

Prof. John Parker, Director of the Cambridge University Botanic Garden, speaker on *The Quick and the Dead: the nature, origin and significance of Cambridge's plant collections*

Photos courtesy of John Stone

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Museum seeks Open House volunteers

The Museum of the Royal Pharmaceutical Society is taking part in this year's London Open House weekend by providing guided tours of the Society's headquarters and the museum displays on the morning of **Saturday 18th September**.

As in previous years, it would very much welcome any voluntary guides to assist museum staff in showing visitors around the building. Full training given, travel expenses paid, and the possibility of an Open House pass that allows priority entrance to other participating buildings over the weekend.

If you are interested or would like further information, please contact Briony Hudson, Keeper of the Museum Collections, RPSGB, 1 Lambeth High Street, London SE1 7JN, 020 7572 2210 or bhudson@rpsgb.org

Left: London 'delftware' tin glazed earthenware drug or display jar with the coat of arms of the Worshipful Society of Apothecaries of London. 40 cm high, dated 1647

Postcards and greetings cards from the Museum

One of the range of 24 postcards and 4 greetings cards on sale on behalf of the Museum from the Library issue desk at 1 Lambeth High Street. All the cards show images or objects from the Museum's fine collections. Reproduced with permission.

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British Society for the History of Pharmacy

840 Melton Road, Thurmaston, Leicester, LE4 8BN
Tel: 0116 264 0083, Fax: 0116 264 0141, Email: bshp@associationhq.org.uk
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The British Society for the History of Pharmacy was formed in 1967 under the aegis of the Pharmaceutical Society of Great Britain, having originated from its History of Pharmacy Committee.

BSHP seeks to act as a focus for the development of all areas of the history of Pharmacy, from the works of the ancient apothecary to today's ever changing role of the community, hospital, wholesale or industrial pharmacist.

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The *Pharmaceutical Historian* has been published since 1967, at first intermittently, but on a regular quarterly basis from 1972.

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Diary

Wednesday 22 September 2004
'Centenary of Pharmacy at Whipps Cross Hospital' by Pat Stone, RPSGB Lambeth, 6.30.
Wednesday 17 November 2004
'A Pharmaceutical History of Radiology' by Dr Adrian Thomas, RPSGB Lambeth, 6.30.
22–25 June 2005 Edinburgh
37th International Congress of the International Society for the History of Pharmacy
The Congress will be organised by the British Society for the History of Pharmacy. All members of BSHP are members of the ISHP. The BSHP will not be holding its usual Spring Conference in 2005. Details will be circulated to members.
1-4 September 2005
BSHM 21st Congress at Exeter. Details from Secretary.

Proceedings of ISHP Congress 2001
Copies of the proceedings of the 35th Congress held in Lucerne in 2001 are now available from Peter Homan, honorary secretary, on a PC compact disk.

Treasurer
John Iles intends to retire as treasurer of BSHP and would welcome enquiries from members who would be interested in taking on the office.
Email: johnbettyiles@homechoice.co.uk

Dr William E Court It is with deep regret that we report the death of Bill Court on 26 July at Mold. He was President of the Society 1982 and 1983 and served as Joint Secretary 1976-91 and Vice-President 1980, 1981. He was reader in pharmacognosy at Bradford University and a regular contributor to the *Historian* and a speaker at BSHP conferences.

Pillars of the Community: Some Pharmacists' Contributions to Public Life

Dr Annie McAuley Brownfield-Pope

Pharmacy has always had its controversies. From the establishment, in 1841, of the Pharmaceutical Society of Great Britain, disputes arose over pharmacy's standing. Was pharmacy a trade or profession? Pharmacists have always attempted to draw a line between the commercial and professional aspects of their calling. Yet, as was recognised by a prominent twentieth century moderniser, the boundary between professional and commercial is neither clear nor static, especially for professionals who practice within a commercial structure. Addressing the Pharmaceutical Conference of 1921, Ernest Saville Peck refused to be 'inveigled into an endeavour to differentiate between a trade and a profession, nor to affirm that one is more worthy, desirable, or honourable'.[1] He added, 'many so-called professional men carry on their profession in a purely commercial spirit, while many so-called tradesmen bring professional instincts to bear'.[2] Regardless of these debates, pharmacists – the majority of whom were retailing, or general practice, chemists – saw themselves as bound to public service whether as 'the poor man's doctor' or, from the early twentieth century on, as key members of state sponsored health care. This being so, it was natural that many of those entering pharmaceutical practice felt obliged to improve the lives of those around them. The arguments persist. A recent consideration of values and the practice of pharmacy maintained that 'what pharmacists think they ought to do is ... likely to be determined by what they must do rather than the other way round'.[3] Yet as this paper will show, as part of their involvement with the public, chemists and pharmacists have regularly gone beyond the rules and precepts imposed upon them.

At this point we encounter another debate. 'Pharmacists' contributions to public life' is a rather nebulous concept. What exactly is public life? I would argue that in its loosest sense 'public life' might be seen as any area within which actions are taken intended to improve the conditions of others. I would further argue that the inclusion of some apparently expedient behaviour is quite reasonable. Actions that may appear

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as purely egotistic can in truth have unexpectedly altruistic consequences. In the same way, apparently altruistic behaviour may well confer material rewards. If we accept this then, in certain circumstances, activities relating to pharmacy itself can qualify as contributions to public life and service. The notion of public service has historically been part and parcel of the pharmacists' role, although the way in which this service was accomplished varied according to the ability and scope of the individual. While some, such as William Glyn-Jones and several of his protégés, entered the public arena on a grand scale, many, the majority perhaps, were involved with their communities on a more modest level. But, whether as tradesmen, professionals, or as that strange hybrid, the professional trader, pharmacists have acted as pillars of their communities.

Sir William Glyn-Jones

In any dialogue of pharmacists' contributions to public life, the most obvious figure for discussion is William Glyn-Jones, a veritable 'colossus of pharmacy' whose impact in the public arena remains undeniable.[4] A 'tall spare individual … full of fiery Welsh spirit',[5] Glyn-Jones rose from proprietorship of a pharmacy in one of London's poorest districts to become, among other things, an expert in pharmaceutical law, being called to the bar in 1904. His legal expertise helped amend poisons and pharmacy legislation during the passing of the 1908 Poisons and Pharmacy Act. In 1910, Glyn-Jones entered Parliament, where he was instrumental in National Health Insurance negotiations. Having already come to the attention of David Lloyd George, during the First World War, Glyn-Jones held the post of Parliamentary Secretary to Dr Christopher Addison, Minister of Munitions and later Minister of Reconstruction. On leaving Parliament in 1918, Glyn-Jones became the Secretary and Registrar of the Pharmaceutical Society, and was rewarded for his wartime services with a knighthood the following year.

Glyn-Jones' great work, and the one that he himself cherished, was the Proprietary Articles Trade Association or PATA, an influential, and controversial, protectionist organisation, founded in 1896 and extant until the final years of the twentieth century.[6] The PATA undertook to compile a list of proprietary articles whose manufacturers opposed price-cutting, and to take action against retailers who attempted to sell listed goods below manufacturers' recommended resale price. Glyn-Jones' resolve to extend PATA membership to outside groups, most notably grocers, who were among chemists' greatest rivals for sales of pre-packaged medicines, was the subject of heated discussion at the time,[7] while, in the changing economic and political climate of the 1950s and 1960s, the success of the PATA encouraged charges of self-interest against retailing pharmacists.[8] Latterly, price protection, and the financial support given to it by the Pharmaceutical Society, was regarded by some as damaging, both to the credibility of the Society and to those sectors of the profession who did not practice as independent chemist-retailers.[9] On the other hand, founded in a period of extreme undercutting, the association became a lasting force in the battle for price maintenance, inspiring other groups to follow its example in securing price protection for their goods.

However contentious, even negative, the objectives of the PATA, Glyn-Jones' fierce attachment to pharmaceutical interests and his attempts to enhance practitioners' status cannot be dismissed. At the end of the First World War, Glyn-Jones fought for improved government grants for trainee pharmacists and for the recognition of pharmacy as a distinct calling, separate from mainstream retailing. Directly following his appointment as Secretary to the Pharmaceutical Society, with advice from Sir Henry Dale, a recognised pharmaceutical authority, and the help and support of Henry Greenish, he also instigated the setting up of a Department of Pharmacology. The new department was intended to pave the way for a more scientific model of pharmaceutical education. In 1922, as part of this modernising agenda negotiations were begun to establish a degree level course in pharmacy, in association with the University of London. This was achieved some two years later.

At the same time as he undertook to enhance pharmacy's educational standards, Glyn-Jones' attention was claimed by a major threat to pharmacy's standing, when, as part of its programme to reform industrial relations, the government declared that pharmacy was to be included in the Joint Industrial Council (also known as Whitley Councils, or JICs) for the retail trade. The Pharmaceutical Society attempted to pre-empt such a move by offering to sponsor and manage a separate JIC for the pharmaceutical sector. To comply with Whitley conditions, however, Society funds would have to be spent on setting up an association for chemists' assistants, a suggestion that provoked immediate objections from proprietor chemists who did not take kindly to the notion of spending money on representation that might help their employees to achieve better wages and conditions.

The question was, how far could the provisions of the Charter be extended? Having already professed themselves unhappy with the existing arrangements, Scottish chemists took counsel and embarked on a separate course of action, by means of the Scottish Pharmaceutical Federation. This caused further unrest. In London, it was decided to put the matter to the test by means of a 'friendly' legal action. As Secretary of the Society, Glyn-Jones had lost his 'rights of audience' and was unable to act as the Society's legal representative. Nonetheless, it was assumed the case would be settled in the Society's favour. On a personal level, failure to win the suit might end Glyn-Jones' hopes for a single overarching pharmaceutical body similar to

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that enjoyed by the medical profession. But, despite pressure from other professional bodies, when the case was lost he wasted no time on appeal. An entirely new organisation was formed, the Retail Pharmacists' Union, headed by George Mallinson, another of Glyn-Jones' former assistants.

His unyielding determination and self-generated burden of work gave rise to fears for Glyn-Jones' health. Indeed, the stress of communicating his meaning to colleagues was known to produce a state of exhaustion where, upon leaving a meeting, he would return to his office and recover by lying, unmoving, for many minutes, before again resuming his schedule.[10] But, despite his arduous timetable, another associate remembers Glyn-Jones' presence at student football matches, where he would sit at the back and tell risqué stories.[11] The intense activity to which Glyn-Jones subjected himself led to his early death from a stroke, at the age of fifty-eight.

According to Hugh Linstead, Glyn-Jones was 'active in every field, legislative, administration … education. (As Secretary to the Society) he turned the whole of the organisation of pharmacy in this country upside-down in the course of five or six years'.[12] Among his achievements can be numbered commercial, legal, and educational improvements, all of which, directly or indirectly, affected public life, public service, and the public's perception of pharmacy.

Colonel E.F. Harrison

Other chemists' lives were cut short in the service of the public. The senior partner in Harrison & Self served in the Royal Engineers anti-gas establishment, reaching the rank of Colonel. He was remembered by C.W. Maplethorpe, at the time a junior colleague, as 'a most astonishing man'[13] who arrived at headquarters in University College at 5 pm, having already completed a day's work, and then proceeded to toil into the late evening, sometimes working until midnight. The double responsibility imposed by his wartime service undoubtedly undermined Harrison's health; at the age of forty-nine he succumbed to the 1918 influenza pandemic.

Saville Peck

Like-minded acolytes supported Glyn-Jones in his many projects. Ernest Saville Peck, a Cambridge pharmacist with an abiding interest in the advancement of pharmaceutical education, was notable among them. During the First World War, Saville Peck served with the Army Gas Service, being appointed Commandant of the Eastern Anti-Gas School. A tour of France followed, after which he was posted to military training institutions in America to instruct United States' troops in anti-gas warfare.

After the War Saville Peck was sent to Italy, and to other theatres of war, to acquaint British servicemen with the details of government training grants. A distinguished scholar, holding Bachelor and Master degrees from Cambridge University, he spent many months on his return travelling the country to keep an eye on educational standards in the wake of a rapid increase in student pharmacist numbers. He met with education committees and universities to demand new and better programmes of study, telling them, "You owe it to the boys."[14] He called on several schools in Scotland, for example, noting where even the smallest improvements might be made. Where conditions were poor, however, and promises of improvement broken, Saville Peck had no compunction over reassigning contracts.[15] Following the Society's decision to support the move away from private training establishments, Saville Peck visited these schools, advising on their suitability for closure, purchase, or merger with existing public provision. In 1921, Saville Peck spoke of his thoughts and aspirations, which were 'nothing less than the evolution of a real profession of pharmacy'.[16] He described this evolution as a goal, the achievement of which would be accomplished by tackling a series of immediate objectives, in order to reach a final end. Saville Peck's activities outside pharmacy saw him elected to Cambridge Town Council, in 1924, where he served on several committees dealing with health and educational issues. He took office as mayor in 1937-38, and was subsequently promoted to alderman. In 1939, he was appointed Deputy Lieutenant of the County. His interest in history and in his local community led him to become a founder member and supporter of the Cambridge Folk Museum.

It would be impossible for all pharmacists' contributions to public life to be on the scale of a William Glyn-Jones, or indeed a Saville Peck, and many served their communities in a more modest fashion. The role of poor man's doctor was taken seriously. Notes from the St Rollox branch of the Glasgow Chemists' Association detail the concerns of a Mr Peacock over proposals to reorganise Glasgow Parish Dispensaries. Changes to the service included the appointment of an unqualified principal dispenser and the opening of district dispensaries, 'under the charge of girls and young lads', and outwith the supervision of a qualified chemist.[17] Peacock had already made economies during his own term as chief parish dispenser. When the service had to be expanded, he had insisted on the appointment of qualified branch managers. Faced with a lessening workload, he later centralised much of the task, contracting out to local chemists where necessary. Peacock felt, however, that the new system, which placed care of the poor in the hands of inexperienced and unqualified personnel, ran contrary to both the letter and the spirit of the Pharmacy Acts. With the support of his branch, he campaigned against this erosion.

Arthur Weddell of Colchester developed an interest in chemical analysis. The quality of water in the Colchester area may be judged from his comments on an unmarked sample. 'From my experience … I have only found it (the presence of Phosphates) from waters drawn from shallow wells in the immediate neigh-

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bourhood of a graveyard … water that has drained through a graveyard which contains decomposing bodies … must show greater freedom from organic matter than this … before it can be considered fit for domestic use'.[18] Weddell's expertise in analysis led to the condemnation of several contaminated sources, reducing local incidences of diphtheria and sickness. In much the same way, a Cromer chemist, B.G.W. Hoare, acted as radiographer at his local cottage hospital,[19] operating 'a most terrifying piece of apparatus with a great glass bulb that you hooked leads on at both ends and the most amazing green light and crackles came out'.[20] This was a dangerous undertaking, for at the time there was no real understanding of, or protection from, the long-term effects of the X-rays. And in the late 1920s, the operator was still unprotected. Mr Hoare, who also developed the plates, undertook these tasks 'over a period of many years', and was credited with having maintained a skilled and continuous presence that contributed significantly to the success of the equipment.[21]

Once more, wartime offered the opportunity to serve the public. Chemists who remained 'on the home front' added civil defence posts to their everyday duties, acting as ARP wardens and anti-gas officers; younger staff joined the Home Guard. Jack Bearman served in a London pharmacy opposite Marble Arch, when 'bombs were coming down all the time'.[22] He and other staff members attended to minor injuries, such as cuts from flying glass, and slept in the basement on makeshift beds made out of sanitary towels. Norman Butler acted as a locum in Birmingham, also during the Blitz. When his pharmacy was bombed out, he repaired the roof and windows sufficiently well with tarpaulin and old photographic plates to keep his shop open. Butler also acted as a firewatcher, before being invalided out to Hereford where he continued his locum duties, sleeping on couches or in air raid shelters. In Portsmouth Brian Hebért was asked to organise a casualty clearing station.[23] With the help of a Sergeant who had a PhC, two partly trained army dispensers, and four pharmacists released from their duties as stretcher-bearers, he kept four operating theatres working around-the-clock, dealing with wounded from the Normandy beaches.

Other chemists have made more unusual contributions to public life. Some engaged in leisure pursuits such as mycology and botany, publishing learned papers on their findings. Others wrote memoirs, or in the case of a famous dispenser, crime novels, romances and an extremely successful play.[24] In the wake of the National Strike, Isaac Renton, a Hackney chemist and committed socialist, published a tract entitled *Money Must Go*. Some pharmacists have become noted historians of the craft, bringing previously ignored aspects of pharmaceutical history to light.[25] Others have saved the very fabric of the profession, including, as those of you who have been to Norwich will know, John Newstead, who donated the Iceni Pharmacy to the Bridewell Museum of Trades and Industry. But perhaps one of the most extraordinary gifts came from Ernest Sayle, a Norwich chemist, who, in response to his customers' need, successfully lobbied for a new bus stop.[26] Mr Sayle's shop is no more, but more than fifty years after his gift to his patients, the bus stop is still in regular use.

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This paper was presented at the British Society for the History of Pharmacy Annual Spring Conference, Cambridge, 3 April, 2004.

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25. Among them, Peter Worling, Stuart Anderson, William Jackson, John Hunt and Nita Burnby, have published on such topics as pharmaceutical wholesaling, hospital pharmacy, the Victorian pharmacy, National Health Insurance and professionalisation.
26. With thanks to Brenda Copsey, née Sayle, for reminiscences of her father.

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The History of Penicillin from Discovery to the Drive to Production

Kevin Brown

Trust Archivist and Alexander Fleming Laboratory Museum Curator, St Mary's Hospital, London

Before penicillin, go in to a Hospital like St Mary's Hospital, Paddington, and you were more likely to leave dead than alive. The great problem was hospital-acquired infection, and without antibiotics there was little that could be done. Across the entire United Kingdom just before the Second World War, the average post-operative mortality rate was 38%. A modern Hospital would be closed, and deservedly. Then it was the norm. The sulphonamides, the best remembered of which was M&B 693, had started to come into use from the mid-1930s onwards but the side-effects were not particularly pleasant.

The scene for Fleming's discovery of penicillin was a small, musty dusty laboratory at St Mary's Hospital, Paddington, old-fashioned even for its time: but sometimes the best work can be done in the sparsest of facilities. What is essentially needed is the right combination of circumstances and the right person able to take advantage of them. Fleming, medically qualified and a bacteriologist, was perhaps uniquely placed to make the initial discovery. One of the abiding myths is that he was merely lucky. On returning from holiday on 3 September 1928, he noticed that a petri dish of staphylococci, on which he had previously been working, had become contaminated by a fungus which had produced a substance that had inhibited the growth of the microbes. That substance he at first called 'mould juice' and later 'penicillin' after the mould which produced it, *Penicillium notatum*. Most people would have seen little significance in the phenomenon if indeed they hadn't missed it completely. Not Fleming.[1]

Louis Pasteur has said in an often-quoted dictum that 'chance events favour only the prepared mind'.[2] Fleming was certainly prepared to take advantage of a chance observation. An observant and meticulous worker, despite his reputation for not working in the tidiest of laboratories, Fleming noticed something others might have missed and asked himself the questions his scientific training had prepared him for. However, he was qualified by his own experience in one unique way to make the most of this discovery. Since the Great War, when he had demonstrated that the liberal use of antiseptics on wounds was doing more harm than good, he had been interested in the search for the perfect antiseptic.[3] Initially he was sceptical, especially when he came under the inspiration of the charismatic Sir Almroth Wright, an immunologist with no sympathy for chemotherapy in any form. Known variously as the Praed Street Philosopher, the Paddington Plato, 'Sir Almost Wright' and 'Sir Always Wrong', this maverick amongst English doctors had attempted to effect a revolution in medicine through vaccine therapy, the use of vaccines to treat disease as well as prevent it. His Inoculation Department at St Mary's became the high temple of vaccine therapy and people came from all over the world to observe his methods.[4] Although unpopular with his professional colleagues in Britain, Wright was on good terms with the major figures of contempoarary microbiology, including Paul Ehrlich. Indeed Ehrlich sent Wright a sample of Salvarsan, the first effective modern form of chemotherapy, in 1909. Intellectually opposed to such an approach to therapeutics, Wright handed Salvarsan or compound 606 over to one of his more open-minded juniors, Fleming, who built up a reputation for himself in the treatment of syphilis in the years leading up to the Great War. Fleming, a volunteer soldier in the London Scottish Regiment, was to be caricatured as Private 606 by his artist friend, Ronald Gray. In the kilt of the London Scottish, he wields a syringe instead of a rifle or bayonet.[5]

In 1921 he discovered lysozyme, a natural antiseptic present in many body fluids, when he had a cold and a drop of nasal mucus fell on to a culture plate and began to lyse the bacteria. A cartoon in the satirical magazine *Punch* showed schoolboys queuing up to be thrashed in return for a penny to produce this tear antiseptic, but there was never any great commercial or even clinical advantage to be had from the discovery as lysozyme had no effect on the bacteria most pathogenic to mankind. Fleming was always to claim that his best work as a scientist was done on lysozyme. This was not modesty but truth.[6] Penicillin may have had a greater impact on the world, but as a scientist Fleming did do his best work on lysozyme. When he saw the effect penicillin had on bacteria, his first thoughts were that this could be a more potent enzyme than lysozyme with therapeutic advantages. In fact it was the first of the antibiotics to be discovered.

In these days of research grants and tight deadlines, it would not be so easy for any researcher to go off at a tangent and investigate an interesting phenomenon apparently unrelated to the main work at hand. In 1928, funding for medical research may have been much more haphazard, with Fleming's Department funded from the commercial sale of vaccines, but there was perhaps more autonomy and the freedom to go off in new, untested directions that may have been cul-de-sacs of failure or may have opened the road to a breakthrough. If Fleming had not kept the mould alive, investigated it and published his findings, none of what followed would have been possible. So, Fleming set to work to investigate further with the help of Craddock and Ridley. These two young researchers were given a sink in a corridor outside one of the wards close to a sluice at which to work – modern researchers might well ask what has changed? Craddock, perhaps foolhardily, tested its toxicity by eating some of the mould which tasted like Stilton cheese. These two young men were not chemists nor biochemists and indeed they had to learn the principles of chemical extraction from elementary school textbooks as they went along. It is to

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their great credit that they came close to solving the problems of purification and stabilisation but sadly not close enough.[7] However, they were unable to stabilise or purify the penicillin, which limited its clinical potential.

Fleming published a paper in 1929 on the value of penicillin for the isolation of *Haemophilus influenzae B*,[8] and laboratories all over the world, including the Sir William Dunn School of Pathology at Oxford, asked for samples to use for the isolation of resistant strains of bacteria. Fleming himself was using penicillin to isolate *Haemophilus influenzae B*, Pfeiffer's bacillus, in order to produce an anti-influenza vaccine for sale through the pharmaceutical company of Parke, Davis. He was responsible for the production of the vaccines so important to the funding of the Inoculation Department at St Mary's. It was this laboratory use that kept the mould alive and available, not as yet its therapeutic potential.

Fleming has been charged with having lost interest in penicillin except for its use in vaccine production and of failing to realise its therapeutic potential. In fact he made a further attempt to overcome the purification problem in 1934, with the help of Dr Lewis Holt, and continued to show an interest in penicillin in his notebooks as late as 1939.[10] Meanwhile further attempts were made by Harold Raistrick at the London School of Hygiene and Tropical Medicine and by Roger Reid in Pennsylvania, all without success. In New York Charles Thom studied the mould and its product using a sample sent to him by Harold Raistrick.[11] Early interest in penicillin was not confined to Britain but crossed the Atlantic. However, at this stage there was little co-operation, merely scientists working in isolation.

It was shortly before the Second World War that a research team at Oxford led by the Australian pathologist Howard Florey began work on penicillin that was to take it from a laboratory curiosity to a life-saving drug. At the beginning of their work, they were not interested in therapeutic applications, though they quickly became aware of these. Pure, not applied, research at first, it was to lead to a clinical breakthrough The biochemist Ernst Chain, a German Jewish refugee, and Florey himself were to be awarded the Nobel Prize jointly with Fleming in 1945, but credit must surely go to the whole team. Multidisciplinary teamwork was vital for the clinical development of penicillin and was a pointer to the future of medical research. Co-incidentally they had just completed an investigation of Fleming's other great discovery lysozyme and, as earlier with Fleming, it was the superficial similarities of penicillin and lysosyme which attracted the interest of Chain, an expert on enzymes.[12] A small team by modern standards and very loosely organised, they were one of the largest medical research teams in 1939, even though there may have been no more than eight of them working together at any one time.[13] The importance of team work in this context may be considered in comparison with Fleming, very much the lone researcher of an earlier phase in the history of medical science, working by himself, assisted only by two young lads and, consequently, not in a position to effect the breakthrough achieved at Oxford.

The Second World War made the task of the Oxford team all the more difficult. Legend has it that in the event of an invasion, the team had samples of the mould smeared inside their clothes and planned to escape to North America to continue the work. In wartime conditions, equipment was ingeniously devised using milk churns, baths, fridge coolants, bicycle pumps, biscuit tins and bedpans. The mould, grown at first in makeshift culture vessels and then in fermentation vessels designed by Norman Heatley, who died in January 2004, and tended by 'penicillin girls', was extracted into amyl acetate and then back extracted into water by use of a counter-current system. Impurities were then removed with the newly developed technique of alumina column chromatography. The penicillin was concentrated, at first by vacuum distillation and later by the relatively new technique of freeze-drying.[14] The Sir William Dunn School of Pathology had effectively been turned into a penicillin factory and for a time was the only source of supply in Britain.

Heatley's development of methods of cup assay and introduction of his arbitrarily defined Oxford units as a definition of penicillin antibiotic made possible the assessment of the effectiveness of the drug, which was first used systemically on a patient in February 1941. The Oxford Unit later became the international assay standard for penicillin.[15]

Pilot production

However, in wartime Britain it was not an easy task to get pilot production underway at a time when munitions came before pharmaceuticals. On the advice of Sir Edward Mellanby of the Medical Research Council and supported by a travel grant from the Rockefeller Foundation, Florey and his colleague Norman Heatley set off on a mission to the United States in July 1941 to get large-scale production going. Florey's personal aim was to obtain North American supplies for his own clinical trials, although this ambition, not surprisingly, was to be frustrated by North American demands for the drug.

Heatley went to work at the Northern Regional Research Laboratory of the US Department of Agriculture at Peoria, Illinois, which had been established as a New Deal initiative to find alternative uses for agricultural products. It had newly developed fermentation facilities which were essential if the aim of increasing yields was to be successful. The speed with which it all took place was a reflection of the importance in which the work was regarded by the government of the United States as part of its 'medical defence plans'.[16] The programme to increase penicillin yields which now began under the direction of Robert Coghill, Chief of the Fermentation Division, was to continue for the next four years, work which could truly be described as the basis of all further wartime biological developments of penicillin.

Norman Heatley found himself working closely with

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Andrew Moyer on the difficult task of finding answers to the problem of producing the new drug on an industrial and economical scale. It was not made any easier by an uneasy relationship between the two men, exacerbated by the anti-British and isolationist stance taken by Moyer as war approached, not an uncommon attitude in the American heartlands at that time but one which did not make transatlantic co-operation one whit easier.

In the search for the optimum conditions for the production of penicillin, Moyer soon found that he could increase the yield by substituting lactose for the sucrose used by the Oxford team in their culture medium. He then discovered that by adding corn-steep liquor to the fermentation medium he could increase the yield by ten times. There was nothing remarkable about this decision to use corn-steep liquor, a by-product of the corn wet-milling process.[17] They tried it out in all their fermentation work as a matter of course. By the time Heatley left Peoria at the end of November 1941 after training the staff there in his methods of penicillin assay, he and Moyer were able to report to Coghill that

> the study has resulted in a greatly improved method for penicillin production whereby yields are increased twelve-fold over those previously reported.[18]

The surface culture method of growing the mould used at Oxford was an inefficient and uneconomical method of growing the mould compared to growth in submerged culture. When grown on the surface of a culture medium, the *Penicillium* mould could only penetrate no more than one or two millimetres below the surface so that a large surface area was required to grow any significant quantity of penicillin. This in turn required an enormous number of culture flasks, either closed bottles or open trays. Unless the penicillin could be grown in submerged tanks or vats, it seemed that it would be well nigh impossible to produce it in sufficient quantities for widespread clinical use. The next step, having found a growth medium that greatly increased yields of penicillin, was to experiment with growing the mould in deep tanks below the surface of the culture medium, but it was here that the team at Peoria found a new difficulty. The problem was that the strain of *Penicillium notatum* brought to Peoria from Oxford only produced traces of penicillin when grown in submerged culture in a constantly aerated and agitated mixture in deep tanks.[19] The search was on for a faster-growing strain of *Penicillium*.

At first it had been thought that only the Fleming strain of *Penicillium notatum* actually produced penicillin, but then the researchers observed that most strains of the chrysogenum-notatum group of penicillia moulds produced it in greater or lesser quantities. Another strain of the fungus was found in the culture collections of the Laboratory at Peoria, which produced a more stable form of penicillin but with lower yields. Under the direction of Kenneth B. Raper, staff at the NRRL screened strains of the mould sought from around the world with the help of the Army Transport Command until they found one capable of producing sufficient penicillin in submerged culture. Raper believed that there might be an organism in soil which could produce larger quantities of penicillin. As a result, samples of soil were delivered daily to Peoria from all parts of the world in bottles, paper bags and paper cartons. Good penicillin-producing strains of the mould were found as far away as Cape Town, Chungkin and Bombay, but ironically the best of all was actually found in Peoria itself. Legend associates this with Mouldy Mary, a worker at the lab given the task of searching for moulds, one of which she found on a cantelupe in a local market. The records actually show that the sample had been sent in by a local housewife.[20] Whatever the source, it was found that the productivity of this mould was further increased after exposure to x-rays at the Carnegie Institute and ultraviolet radiation at the University of Wisconsin.

Crucial to the success of the penicillin project in Peoria was Andrew Moyer, yet he has somewhat unfairly been painted as the villain of the piece, at least on the British side of the Atlantic, for having taken out patents on the work he undertook with Norman Heatley, without Heatley's knowledge or consent. I would like to dismiss one particular myth here, that penicillin is the archetypal example of British entrepreneurship developing an idea only for it to be commercially exploited by another country. This was a theme taken up by post-war politicians. The penicillin story is not as simple as the oft-quoted tale of lost opportunities, even if it is a myth bound up with British national identity. It was the methods developed at Peoria by Norman Heatley and Andrew Moyer that were patented by Dr Moyer, admittedly without Heatley's knowledge, not penicillin itself. As a Federal employee, he had to assign rights to the Department of Agriculture but was able to take out patents overseas. Similarly when British industry went over to deep tank fermentation techniques for penicillin production in 1945 when new plants were built at Barnard Castle and Speke, procedures were licensed from American firms, Merck, Squibb and Commercial Solvents with the requisite expertise. Accordingly, after the war when the British pharmaceutical industry began to use these more efficient production methods, royalties had to be paid to the States. Fleming, under the patent laws of the time, could not have patented his discovery of a substance occurring in nature. Florey failed to patent the production methods pioneered in Oxford, partly because it was considered unethical and unprofessional behaviour for a medical man in those days, despite Chain being much more commercially aware. However, even had the Oxford team taken out a patent, it was the procedures pioneered and developed in the United States, that were adopted commercially, so the outcome would have been little different. However, this myth is still widely cited and has led to Moyer unfairly being painted on the British side of the Atlantic as the villain of the piece because Moyer had no compunction about asserting what he saw as his rights.[21] Here was the

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archetypal example of British entrepreneurship developing an idea only for it to be commercially exploited by another country. This was a theme taken up by post-war politicians. It was not as simple as that, nor was Moyer's role as murky as it has been depicted.

While Heatley made advances with his scientific work on penicillin in collaboration with North American colleagues, Florey had mixed fortunes in his attempts to win over the American chemical industry. On leaving Peoria, he began what he himself described as a 'carpetbagging' tour of the North American chemical industry, visiting Philadelphia, Toronto, and the mid-Atlantic States. In some places there was encouragement but as yet no offers of practical help. In others the reception was much more discouraging. Merck had been conducting research at Rahway, New Jersey since 1940 as part of a much wider study of antibacterial substances instigated by Selman Waksman of Rutgers University in 1939. Other companies too, including Squibb, Lederle and Pfizer, were interested and considering some work on penicillin. Although many of them had already started some research into penicillin before the arrival of Florey, there were understandable fears about embarking on an expensive project with a drug that at that stage had only been used on staphylococcal infections in limited clinical trials. It was also feared that if the chemists could find some means of synthesising penicillin, any investment in production from the mould might be worthless. The rival firms were also suspicious of each other. The interest was there but something extra was needed to get the project off the ground.

What made the difference was the support of the Federal Government. The Office of Scientific Research and Development had been established by President Roosevelt to prepare scientifically for what was now seen as inevitable involvement in the world war. Its major achievement was the Manhattan Project leading to the development of the atom bomb, but on a similar scale was penicillin. Both Vannevar Bush, Director of the OSRD, and A.N. Richards, Chairman of the Committee on Medical Research, saw the importance of penicillin for the war effort. Richards wasted little time in mobilising those sections of American industry in a position to push forward penicillin production.[22] At a meeting of the Committee on Medical Research held on 2 October 1941 he was authorised to

> suggest to interested persons the desirability of a concerted programme of research on penicillin involving the pooling of information and results.[23]

Very little was agreed at meetings of representatives from the Government, the Universities and the chemical and pharmaceutical industries held in October and November 1941. Everything had changed by the time of the third meeting held at the University Club in New York on 17 December 1941 and there was now no holding back by anyone. The reason – a date that will live in infamy, one that had the resonance of 9/11 today: December 7th. Now, ten days after Pearl Harbour, entry into the war and favourable reports on the successful use of corn-steep liquor at Peoria from Coghill, had given a massive impetus to commercial involvement in the production of penicillin.[24]

Wartime production

However, the outbreak of war was to have mixed results for penicillin production. Whilst, the antibiotic was obviously of great value to the war effort, other things, as in wartime Britain, were considered of greater importance. The War Production Board gave priority to rubber, essential for so many things from tyres to boots, now that the Japanese had severed imports from the Far East. To aid the quest for alternatives, the United States Department of Justice allowed chemical, rubber and petroleum companies to freely pool and exchange commercial information. This move, which was so at odds with normal competitive instincts in business and also against the spirit of anti-trust legislation with its fear of cartels and monopolies, set a precedent for the exchange of information between competing industrial firms which was to encourage co-operation in developing penicillin commercially. Nevertheless, it was not until 7 December 1943 that the Attorney General exempted penicillin from the operation of the anti-trust laws, an exemption given to no other drug. Until this time, pharmaceutical firms had pooled information but only by violating the legislation with official connivance. Moreover, the War Production Board was able to allocate some building materials, raw materials and manpower for penicillin production, and encouraged co-operation. Tax relief was given to firms to offset the risk of plant being made obsolete by the advent of synthetic penicillin. An 85% tax on excess profits also encouraged investment in research and development. However patriotic industrialists might have been, there was still a point at which it was better to retain as much profit as possible rather than lose it to government coffers even if it was to support the war effort. What a contrast to present day policies in the United States and elsewhere!

In such a situation, the pharmaceutical and chemical industry rose magnificently to the challenge of scaling up production to a manufacturing scale. Collaboration and the sharing of expertise between companies via the Committee on Medical Research enabled the transition to mass manufacturing to progress more rapidly and smoothly than would have been possible in peacetime beset by the usual commercial rivalries. The big players initially were Merck, Squibb, Pfizer, Abbott and Winthrop, all of whom gambled large sums of money on bringing penicillin into clinical use. It was risky to invest so heavily in this new relatively untried drug, but it was a risk that was to pay handsome dividends in the future. Each company played its part, according to its own brand of expertise or previous production experience. Merck and Squibb joined in a collaborative programme in February 1942 and agreed to make their data available to other companies and to hand over all the penicillin they produced for distribution for clinical trials through the Committee on Medical Research.

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Whilst the work of the Northern Regional Research Laboratory had conclusively shown that the future for large-scale production lay in the use of deep tank fermentation, most of the penicillin being produced in the United States continued to be produced in shallow layers in flasks, bottles and pans. Merck and Squibb indeed concentrated on the enlargement of their pilot plants, working from the assumption that the drug would soon be synthesised and fermentation plants proved to be unnecessary.[25] It was left to a new player in the drugs industry to take the necessary steps towards establishing a commercial-scale fermentation plant. Pfizer, pioneers of deep vat fermentation techniques for the production of citric acid for the food and drink industry, adapted these processes for penicillin production. By 1943 Pfizer was producing penicillin in fifty-gallon tanks and in 1943 at Brooklyn opened the first plant to produce penicillin from 'a mould that was as temperamental as an opera singer' in 7,000-gallon tanks on a mass scale by submerged culture. Unlike some of the more traditional pharmaceutical companies, there was more of an entrepreneurial spirit at Pfizer, a newcomer to the drugs industry anyway.[26]

Not all production, by now under the supervision of the War Production Board, was on such an industrial scale. Surface culture continued and was officially encouraged because at first there was no certainty that submerged culture would succeed. Indeed throughout the war, the official attitude was that synthesis was always just round that elusive corner. Ronald Hare, in charge of penicillin production at the Connaught Laboratories in Toronto and a former colleague of Fleming, was scathing about some smaller North American factories 'started by amateurs who seemed to be doing it as much for fun as from patriotic or pecuniary motives'. One of these was a firetrap in a basement full of flammable liquids presided over by a gum-chewing chemist, whilst another businessman was re-using old whisky bottles in a derelict Brooklyn factory.[27]

Yet it would be wrong to argue that patriotism and government direction overcame normal commercial considerations. The pooling of information between firms was not always as effective as it might have been. Eighteen companies were involved with eighteen different methods. Britain, with its lesser production capacity and shortages of war materials impeding production, was perhaps superior to the United States in one respect only, the exchange of information between firms. In America, corporate rivalries precluded full exchange of information, as Albert Elder, Co-ordinator of the Penicillin Program from 1943, acknowledged when he wrote that

> Progress could have been much more rapid with a free interchange of material. One industry man said that as he saw my job, I was to go from one plant to another collecting honey, but I was not to distribute pollen along the way.[28]

Individual firms were very much aware of their own post-war interests when it would be an advantage to be ahead of the game in meeting mass demand for penicillin.

In Britain, production was scaled up gradually despite the pressures of competition for scarce resources from plants producing the sinews of war. The surface culture methods pioneered by the Sir William Dunn School at Oxford were adopted elsewhere and were the basis for British industrial production until the end of the war. Production was co-ordinated by the Penicillin Committee set up by the Ministry of Supply after Fleming visited his friend and fellow Ayrshire man Sir Andrew Duncan, Minister of Supply in 1942. It was decided in view of the dangers of national production being wiped out by one single bomb to disperse production throughout the country. Disused cattle feed and cheese processing factories were brought in to use. There was some discussion in 1944 about putting penicillin on the secret list as a 'munition of war', but it had been so well publicised as to which firms were producing it and where, that such action would have been redundant. There was also suspicion that not all firms were fully pooling information. The firm of Kemble Bishop, which had a licence from Pfizer for citric acid production and which had supplied Florey with crude mould, came under intense official pressure because it was erroneously believed that it had knowledge from Pfizer about fermentation techniques in relation to penicillin production.[29] When Britain came to plan for post-war penicillin production, it was decided, following a visit to the United States on behalf of the Ministry of Supply by Harry Jephcott of Glaxo and William Boon of ICI, to build the two new planned plants at Speke (Distillers) and Barnard Castle (Glaxo) so that submerged-culture production could be introduced.[30]

On both sides of the Atlantic, military pressure encouraged penicillin production. The armed forces offered a source of human guinea pigs for trials of the new drug. Clinical trials at Bushnell and Halloran military Hospitals convinced the army of the importance of penicillin to the war effort and intensified demands for the prioritisation of its production. The Surgeon-General Norman T. Kirk himself wrote to Richards for information on the status of penicillin production on 5 June 1943 and was reassured that industrial expansion plans were on course.[31] This pressure intensified as demands for use on the battlefields grew and penicillin proved itself in the theatre of war as much as in the operating theatre. British Prime Minister Winston Churchill said that penicillin must be used to the best military advantage. This was interpreted as treating sufferers from sexually transmitted diseases rather than battlefield casualties. You could get them back into action quicker.[32] By the time of the invasion of Sicily in 1943 it came in to its own on the battlefields for the liberation of Europe. At this stage, American supplies supplemented British production, but by D-Day and the Normandy landings of June 1944 Britain was producing sufficient penicillin for wide-scale use on battlefield casualties.

The impact of penicillin on military medicine was dramatic in its effects. In 1944, only 4.5% of wounds in the US army proved fatal and 3.2 % in the US

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navy. An American soldier's chances of dying in the Second World War were 1 in 100, a third of the Great War rate and a tenth of the Civil War rate. This was thanks to improvements in blood transfusion as well as the availability of penicillin, but it was penicillin which hit the headlines.[33]

Demand was enormous, especially following the publicity surrounding the treatment of Mrs Anne Miller of New Haven, Connecticut, whose life was saved in March 1942 and the case of baby Patricia Malone which tugged a nation's heart strings in the summer of 1943. Further publicity came with the release of penicillin for the treatment of staphylococcal infections in the respiratory tracts of victims of the Coconut Grove night-club fire in Boston in November 1942. Already the value of penicillin in treating burns victims had been shown by Flight-Lieutenant D.C. Bodenham working with the RAF from June 1942.[34] Dr Chester Keefer of Boston, Chairman of the National Research Council Committee on Chemotherapy, who was charged with the rationing of penicillin supplies for civilian use, was inundated with heart-rending requests for this life-saving substance. With 85% of penicillin production going to meet military demands throughout the war, there was very little available for civilian use and a strong case had to be made for every application for its use. On the one hand were the very strong personal factors relating to individual patients whose lives could be saved if they could only be given the drug. Against these individual needs was the demand for scientific data to assess the clinical effectiveness of penicillin and its use in non-life-threatening situations. If it was to be understood and used effectively, it was essential to collect data on its dosage, methods of administration, length of treatment and any adverse reactions. Keefer had to reconcile these competing interests and keep everyone happy. Somehow, he managed to do so until April 1944 when there was so much penicillin being produced that it was beyond the capacity of one man to manage its equitable distribution. Now the Penicillin Producers Industry Advisory Committee took on the responsibility of devising a plan for its distribution through nominated hospitals.[35]

Mass production

Fortunately, production increased from 21 billion Oxford units in 1943 to 6.8 trillion units in 1945, whilst prices fell from $200 per million units in 1943 to $6 per million units in 1945. In the summer of 1945 monthly production figures for penicillin briefly fell as a result of a shortage of corn-steep liquor, but that was only a temporary blip. The speed at which production increased was astounding and as mass production rose the unit costs of producing it fell to affordable levels.[36] By March 1945, restrictions on the civilian supply of penicillin in the States could be lifted. British civilians had to wait until June 1946. The dream of penicillin being available for all was at last realised, even before war had given way to peace time. However, while it had still been in short supply, there was something of a penicillin mania and talk of wonders that the peace would bring such as penicillin toothpaste, with the promise of no more dental decay, and penicillin lipstick to be marketed for that hygienic kiss![37] Luckily this never came about as already the bacteria had started to fight back and develop resistance. Fleming had warned of this as early as 1944, at a time when most people saw penicillin as the universal panacea and a once and for all end to the fight against infection. Would that it had been!

With the liberation of Europe came questions as to what information on production methods should be released to both allies and neutral countries. Penicillin also became of some importance in diplomacy. In 1946 the British Foreign Office was so concerned that the United States was benefiting from the supply of penicillin to Bulgaria 'not only to enhance their prestige vis-à-vis the Russians, who have no penicillin at all, but to consolidate their own situation as a humanitarian and altruistic people' that it became a matter of urgency for the British Embassy to supply British penicillin as a reminder that penicillin was 'one of the most important achievements of a British scientist'. Britain was also opposed to American plans to develop penicillin production in post-war Germany. One official even commented that 'The Germans have existed for many centuries without penicillin and I am not quite sure if it is necessary for them to have it now.'[38] The justification given for supplying any penicillin to German civilians was to safeguard troops from gonorrhoea and prevent the spread of ultra-virulent strains of *Streptococcus* back to Britain. If there was opposition to the defeated enemy being given access to penicillin technology, there was even more to its export to a former ally once the Cold War had begun in earnest. It was feared that fermentation equipment might be of value to the Russsians in developing biological weapons.[39]

The effect of the Second World War had been to override commercial rivalries and allow for the transmission of information between two allied nations, between government bodies and commercial companies and between competing firms. This was not always smooth nor as effective as it might have been in an ideal world, but it did take place. War is destructive and the priority given to the sinews of war may have been an impediment to more peaceable development, but it did give a greater sense of urgency and an impetus to co-operation without which the history of penicillin would have been very different. Coghill spoke truly when he stated that:

> Penicillin is a more or less direct ... by-product of the war. It has probably saved more lives and eased much more suffering than the whole war has cost us.[40]

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Bleeding with Leeches

W. A. Jackson

The therapy of bleeding by allowing leeches to suck the patient's blood has been used for more than two thousand years. In that period its popularity has varied considerably, probably rising to an all-time high about the middle of the nineteenth century. After virtually falling into disuse throughout much of the twentieth century it is gaining popularity again to prevent the formation of troublesome blood clots in microsurgery.

The Extravasation of Blood by the Medicinal Leech

The leech most commonly used for therapeutic purposes is the medicinal leech, *Hirudo medicinalis*. This is a parasitic annelid worm in which both ends of the body terminate in a disc-shaped sucker, that enable it to progress by contracting and expanding its body while alternately attaching and releasing each sucker. In addition, when it is fully extended it can swim with an undulating motion.

In order to feed it attaches itself to its chosen host by the anterior sucker, raising the skin slightly. It has three jaws, each of which possesses approximately one hundred very sharp teeth and these puncture the skin, making a triradiate wound resembling the Mercedes-Benz emblem. Hirudin, a substance produced by the leech's salivary glands, is injected into the wound and acts as a powerful anticoagulant. These glands also produce hyaluronidase, a spreading factor which increases the permeability of the skin of the host, mucus, which acts as a lubricant, a histamine-like vasodilator and a local anaesthetic. The leech continues to feed

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until it is satiated, when it releases its hold and drops off. However, frequently the wound continues to bleed due to another constituent of the leech's saliva, a substance called Calgin that binds to collagen and prevents it from inducing the formation of blood clots.[1]

The ingested blood passes from the pharynx into the crop which constitutes the major part of the gut. Here it is stored for long periods, but is prevented from putrefaction by an antibiotic produced by *Aeromonas hydrophila*, a bacterium which lives in the gut of *Hirudo medicinalis*.[2] In the 18th century Motherby had observed that 'Some think that leeches have a poisonous quality, because the wound they make sometimes heals with difficulty.'[3] It is now thought that due to this bacterium, leeches may be an important source of wound infections.[4] It is now acknowledged that leeches should never be used more than once because of the risk of cross-infection.

The Early History of Leeching

Hippocrates does not mention the application of leeches for bleeding and there are conflicting opinions about the first reference to their use for this purpose. Motherby[5] and Anthony Todd Thomson[6] nominated Themison, a Roman physician who was active in the 1st century BC and suggested the application of a cupping glass to draw out more blood after the leech had become gorged and dropped off. However, William Brockbank, a Manchester medical historian claimed that Nicander of Colophon in Ionia, who flourished 197–130 BC was the first to write about the therapeutic use of the leech.[7]

Pliny the Elder (23–79 AD) believed that once leeches had been used, it was necessary to repeat the treatment about the same time each year after. He also thought that there was a possibility that their heads might be left in the flesh, causing an incurable wound that resulted in death. To avoid this, he suggested snipping off their tails while they were sucking so that, as they died, their heads would contract and not be left behind.

Galen of Pergamum (c.130–201 AD) was concerned about the ill effects that might result from swallowing a leech (a fear that was to persist for centuries afterwards) and suggested swallowing snow or a draught of urine to detach it. Appolonius Mys advised taking very bitter vinegar mixed with urine to detach the leeches, followed by snow and purges to expel them *per anum*.[8]

Arabic Medicine

Avicenna gave detailed instructions for the use of leeches, stressing the importance of their application to an area that was clean and free from hair. To obviate the danger of their crawling into the gullet, nose or anus he suggested drawing a thread through their tail end. This should be done from above downwards, not from side from side, to avoid damaging the leech's large blood vessels. He gave a variety of substances that could be applied to them for their removal – salt, pepper, ashes, nitre, or bristles, sponge or wool that had been burnt. The place where they had been used should be cupped to remove any blood containing toxic substances left in the wound, and the patient should not be left until the bleeding had stopped. Leeches that had been used in cases of typhoid, cholera or smallpox should not be used again.[9]

After the early Christian period there is thought to have been a decline in the practice of leeching, and although many compendia of medical prescriptions were known as 'leechbooks' they contained very few references to the use of these creatures, though bleeding and cupping were frequently mentioned.[10] However, its popularity revived in the late 18th century and reached a peak about the middle of the 19th century.

Leeching in the 17th and 18th Centuries

The second edition of *The Poor-Mans Physician and Chyrurgion*, written by Lancelot Coelson, a contemporary of Nicholas Culpeper who described himself as a 'Student in Physick and Astrology', was published in 1663 and included a section on 'Bleeding with Horse-leeches'.[11] He does not appear to have regarded the horse leech as a distinct species, as was the case in the nineteenth century, but did remark that some species were venomous. He advised against the use of one variety particularly:

> For those which are thick and have a head thicker than the rest of their whole body, shining like unto glistering worms and are greenish, and have on their back blew or black strokes or lines, and were caught in standing pools, where all manner of stinking carions and other filthinesse is thrown, they are all venomous, therefore in no case use them.

He approved the use of the round liver-coloured ones with small heads and with gold and yellow streaks on their backs that lived in clean, running water. They should be kept for two or three weeks in clean water before use to 'void the viscosity and impurenesse'. The water should be changed every three days and all 'filth and siiminesse' removed by hand before use. They could be used where boxes (presumably the equivalent of cupping glasses) could not be placed, for example on the privities (private parts), gums, lips, the raw flesh of a wound, on the nose, or on the hands and fingers. For treating infected wounds or bites from venomous creatures he suggested removing the leeches from the water and keeping them in little new wooden boxes for three or four days before application. The place where they were to be applied should be washed very clean, and any traces of plaster or ointment removed as the leeches would not tolerate 'pinguidity' (greasiness) or fat. They should be handled with a clean white cloth, not the fingers, and their heads positioned where they were required to draw blood. If they were unwilling to do so, a little pigeon's or hen's blood should be applied, or the place pricked with a lancet or pin to draw blood. If they did not suck sufficiently strongly, or to prevent them becoming satiated with blood:

> … we must then with a pair of cisers clip her asunder above the third part of the body, whereby she will begin to suck farre stronger and with more violence, and as fast as she sucketh, the blood departeth from her through her hindermost parts which is cut away.

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Leeches could be removed before they were satisfied by placing a little salt or wood ash on their bodies. If the wound continued to bleed it should be allowed to do so and even encouraged by applying boxes (cupping) or washing with hot salted water. If however the bleeding continued too long and could not be stopped by compression, a little 'adusted' (scorched or burned) linen should be laid on the wound with a finger, or a cloven bean could be bound over it.

Leeches seem to have been used more frequently in France than in England. In 1712 in his *Compleat History of Druggs* Pierre Pomet observed that surgeons applied leeches found in ponds and ditches to several parts of the body, chiefly in places where it would have been difficult to fix cupping glasses. He considered the best ones to be small with 'small Heads, reddish Bellies, with Streaks upon the Back, and of a Gold Colour, that are to be met with in clear, running Water,' but, like Coelson, recommended that those with 'thick Heads, of a green Colour that shine like Glow-Worms, being streak'd with Blue, and found in muddy waters,' should be thrown away as venomous as they would cause

> Inflammations, Apostems, (abcesses) Fevers and malignant Ulcers, that are sometimes incurable.'

The leeches should be kept in clean water, changed periodically, to which sand and earth could be added.[12]

In Britain before 1800 it was usual to use venesection or cupping rather than leeching when bleeding was considered to be necessary, though leeches were employed for treating headaches, amenorrhoea, nosebleeds, vomiting blood, whooping cough, obesity and black eyes. They were also used on children for fevers, convulsions and teething problems and those patients who were too weak to be bled by other means.[13]

In 1775 Motherby observed 'They are only used for drawing blood, where and when the lancet cannot be conveniently used,' but added that they were sometimes applied to the anus to treat haemorrhoids.[14]

William Buchan in his *Domestic Medicine* said that children were generally bled with leeches, and that it was proper to use them where inflammations appeared in children when teething,[15] but queried the advisability of this, observing that it was 'a very troublesome and uncertain practice' as it was impossible to know the amount of blood taken, could be very difficult to stop the flow of blood, and the wounds were not easily healed. He suggested that if practitioners took more pains and got used to bleeding children (by venesection) they would find that it was not as difficult as they imagined.[16] When piles produced no discharge of blood, but were painful and swollen he suggested that:

> leeches must be applied as near them as possible, or, if they will fix upon the piles themselves, so much the better.[17]

He also applied leeches for the dispersal of buboes and to inflamed testicles, a procedure which he claimed had always been followed 'with the most happy effects'.[18]

The French physician, Guy Patin, had no compunction about using venesection to bleed both young and old. In a letter written in August 1658 he claimed that he had bled children two or three months of age without inconvenience, and in another letter of January 1663 that previously he had successfully bled a three-day-old infant who was still alive thirty-five years later.[19]

Despite both Patin and Buchan, it was considered by many that bleeding with leeches was less dangerous than venesection or cupping and, for this reason, was often used to bleed children and old people. However, as we shall see, it was not without its dangers

The 19th Century

Mr White, a surgeon, reported the case of a two and a half year old girl who died after the application of a leech. This was applied to an inflamed gland under the angle of the child's jaw by her mother on the instructions of an apothecary. When the leech dropped off she applied a warm poultice to the site to encourage the bleeding and put the little girl to bed. Unfortunately the bleeding continued for so long that by the morning she was very weak, and the surgeon who was summoned was unable to save her life in spite of the administration of powerful stimulants.[20]

In 1819 the editor of *The Monthly Gazette of Health* noted that since peace had been established between England and France so many leeches had been imported from that country that the price of English leeches had dropped from seven pounds to fifteen shillings (75p) a hundred. He observed that the puncture made by the French leech was much larger and deeper than that of the native English one, and that this might account for the excessive loss of blood following the recent use of leeches in London.[21]

It was not always easy to get leeches to bite, and some authorities recommended smearing the site with blood or milk before applying them. Anthony Todd Thomson did not believe that this was the best method, and gave detailed instructions for their application. The skin where they were to be applied was washed, first with soap and water, then with pure water, and finally dried thoroughly. Any hairs should be shaved off, and then the leeches were to be taken from the water in which they were stored some minutes before they were to be used and dried with a very soft cloth. If they were unwilling to bite or needed to be placed very accurately, for example close to the angle of the eye in ophthalmia, he found that a method which never failed was to put the leech in a large quill that was cut at both ends, put the head end on the spot to be bled, with a finger placed over the tail end. Once the leech was securely attached the quill was withdrawn. The leech dropped off when satiated, or could be removed at will by sprinkling a little salt on the head.[22]

In the nineteenth century glass leech tubes that were used like Thomson's quill became available and enabled the leech to be accurately positioned. I had an early one, open at both ends, that was about 10 cm in length. Later examples were sometimes closed at one end and could be straight or curved at the open end.[22] These

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were still on sale in 1910 at a wholesale price of one shilling (5p) per dozen. In the same catalogue leeches were offered at 2/6d (12˚p per dozen).[24] However, a curved leech tube that was open at both ends was illustrated in a Red Cross Nursing Manual in 1915.[25]

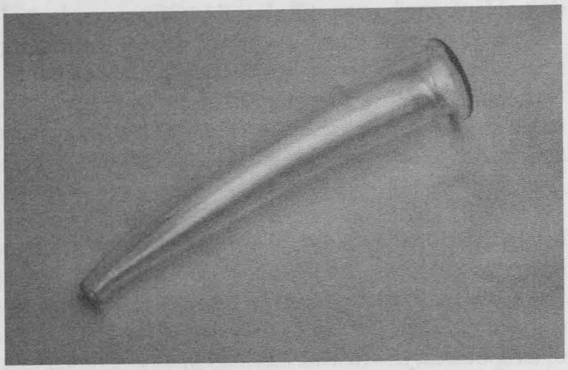

Figure 1.Early Hand-made Leech Tube.

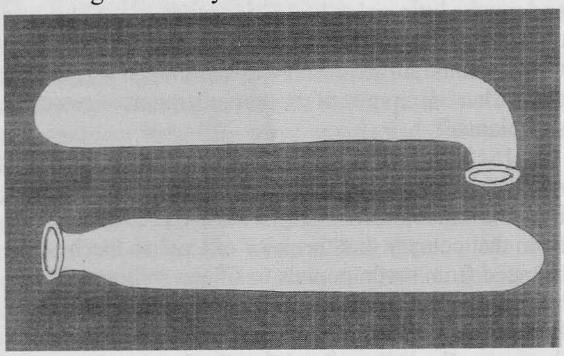

Figure 2. Bent and Straight Leech Tubes.

In the 1840s John F. South, who was a surgeon at St Bartholomew's Hospital, wrote that although leeches were common at the time, thirty years previously they had cost two shillings (10p) or half a crown (12˚ p) each. He said that although they had formerly been imported from France many now came from Syria, and that vast numbers died in transit. He described the medicinal leech that should be used for bleeding, and then said the horse-leeches had blackish brown or dark grey sides and yellowish grey bellies, obviously not the leeches described as suitable by Coelson in the 17th century. Before they were placed on the skin, the site should be carefully cleared of perspiration and wiped with a cool, wet cloth, leaving the skin damp. If they did not take hold, the skin could be smeared with a little sugar solution or sweet beer, and if this failed it could be scratched with the point of a needle to make it bleed. To apply them in one particular spot they should be placed in a small wine glass or the deep portion of a pill box which was then placed mouth downwards on the skin, but if they were required to act over a large area they had to be put on individually. To avoid their becoming overheated they should be wrapped in a piece of damp rag and held by the tail until they attached themselves, and unless this happened in a short time they should be returned to water so that they could cool off. After use they should be put on a plate and sprinkled with salt to make them disgorge the blood, and as soon as this occurred they should be placed in plenty of cold water to remove the salt from their bodies. In his book, *Household Surgery,*[26] South was particularly scathing about the idea of cutting off the tail to make a leech continue sucking in the belief that its stomach was not full, saying that this was 'downright nonsense; and one might be surprised at any such absurd proposal, were it not certain there is no lack of simple people to follow this or any other foolish advice.' He was concerned about the number of well-authenticated deaths that had occurred, some of them in the course of twenty-four hours, due to the loss of too much blood. Often an attempt was made to staunch the flow by introducing a piece of lunar caustic (silver nitrate) into the wound, but the remedy he suggested was to insert a moderately-sized darning needle into the skin at one side of the wound, bringing its point and a fair length of the needle out at the other side. This lifted the wound, and a length of silk or thread could be passed under the ends of the needle and wound or tied round it. This normally stopped the bleeding and after three or four days the thread could be cut and the needle carefully withdrawn. (This method was also described in a nursing manual of 1915.)[27] In the event of this failing, he suggested

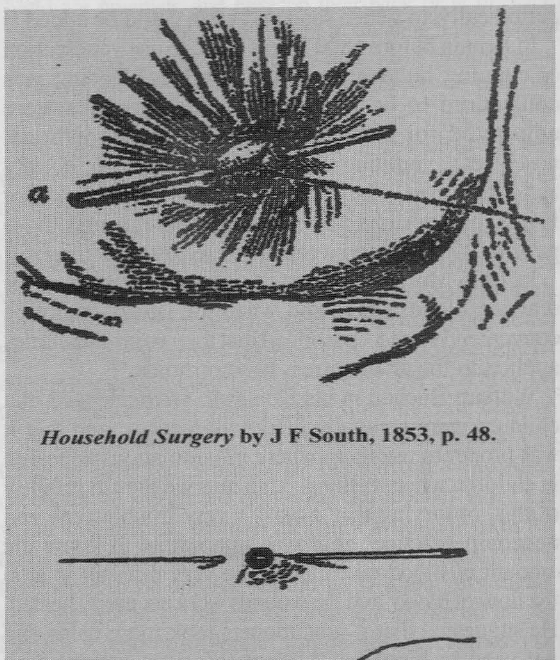

Figure 3. Arresting Haemorrhage from Leech Bite (Reference 25, p.103).

cauterising the wound by thrusting a piece of white-hot iron wire into the bottom of it. He claimed that this method never failed and that if the iron was really white-

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hot all sensation was destroyed in an instant, but it didn't really matter whether the procedure was painful or not as it was the only sure method of saving the patient's life.

John Savory believed that the leeches should be dried using a clean cloth, and that the part where they were to be applied should be clean and dry. Sulphur taken internally or applied externally, tobacco smoke or the smell of vinegar diffused through the apartment would prevent their taking hold. Because of the danger of blood continuing to flow after the removal of the leeches he advised that they should not be used on children late at night unless this was absolutely necessary.[28]

The Early 20th Century

One district nurse recounted that in the first half of the twentieth century she used to wash the patient's skin with plain water as the leeches did not like perfume or disinfectant, and then cover the still moist area with a piece of lint in which holes had been cut to allow the leech to bite. In the absence of a leech tube she partially filled a test tube with cotton wool, slipped the leech into this with its mouth towards the opening, and then tilted the tube until the sucker made contact with the skin, when hopefully the leeches would take hold, though sometimes they needed to be encouraged by the application of a little sweetened milk. One old eye surgeon regularly used to prescribe three leeches above the eyebrow for the relief of congestion. If the blood continued to flow after the leeches had become satiated and dropped off a styptic was applied. She said that although some other hospitals used to destroy their leeches after use, they dropped theirs into a jar of strong salt solution so that they regurgitated the blood and could be used again.[29] Placing used leeches in a vessel containing a little salt to make them vomit the blood they had absorbed was also recommended in *A Handbook for Nurses* published in 1921.[30] As we saw previously it is now considered to be a dangerous practice to apply a leech to another person after it has once been used.

Hospitals and the General Public

Great numbers of leeches were used in hospitals, particularly in the 19th century, their use growing throughout the first half, reaching a peak about 1850, and then declining again. Probably more were used in France than in England. In a description of the treatment of one patient in 1819 at the Hôtel Dieu in Paris, the famous surgeon, Guillaume Dupuytren, used seventy-five leeches on him in one day, as well as well as removing four palettes of blood by venesection. (A palette equals four ounces [114 mL].) He died the same night at 11.00 p.m.[31]

Some idea of how unpleasant treatment could be in the middle of the 19th century can be gauged by the following case history. A 35-year-old seaman named David Brown was struck on his back by the tiller of a boat and admitted to Liverpool Infirmary where he was leeched and later discharged. Shortly afterwards in December 1849 he was admitted to Edinburgh Royal Infirmary with a diagnosis of an aortic aneurysm, and in the following four months eleven pints of blood were taken in addition to the application of leeches on at least six occasions. In the period that followed more blood was let and more than eighty leeches applied. He was also treated with blistering plasters, poultices, opiate enemata and gall and opium ointment. Orally he was given Tincture of Opium, Chloroform Draught, Tincture of Cannabis, Solution of Morphine, Batley's Solution,[32] Jeremy's Solution,[33] Antimony Tartrate, Cajeput (sic) Oil, Decoction of Broom, Sweet Spirit of Nitre, Syrup of Squills, Colocynth and Hyoscyamus Pills, Calomel and Jalap. Eventually he became completely paraplegic, and in May 1852 committed suicide by drinking a liniment containing aconite. Post-mortem examination revealed that he had thoracic and abdominal aneurysms and a tubercle in the right lung.[34]

The accounts of the Manchester Infirmary give some indication of the popularity of leeching in an English provincial hospital. The first specific mention of them occurred in 1782, in which year they cost £1.10s.4d (£1.52). In the 1790s they cost on average £10 per year, and this figure rose to £20 in the first decade of the nineteenth century. From 1810 the annual cost increased rapidly, and in successive years the expenditure was; £50, £89, £90, £129, £144 rising to £209 in 1815-16. In the mid-20s they cost £230, by 1829 £328, by 1832 £361, and in 1840 £373. The annual amount paid for them continued to be more than £300, until 1842 when it dropped sharply to £246 and £150 in successive years. It rose to £394 in 1850 but had dropped to £16 by 1860, and the final entry in the accounts was for 5s.10d. (29p) in 1882. Although the Infirmary continued to buy them after this, they are not mentioned specifically in the accounts. Although there was some variation in the individual cost of each leech during this time, the rise to a peak of the cost in the middle of the century and its subsequent fall indicate the increasing popularity of this treatment and its subsequent diminution. In 1816 they cost two pence each and in 1823 one penny, so the number of leeches used in these years was approximately 25,000 and 55,000 respectively.[35]

Of course the Infirmary, although the largest, was not the only hospital in Manchester. In addition to the hospitals there were the public dispensaries, and leeches were used by surgeons in private practice and the phlebotomists who held no formal qualification. As well as their usual doctors, the general public frequently resorted to 'cuppers and bleeders,' that is phlebotomists who employed scarification and cupping or venesection as a means of drawing blood. In the 19th century the street directories of Man-

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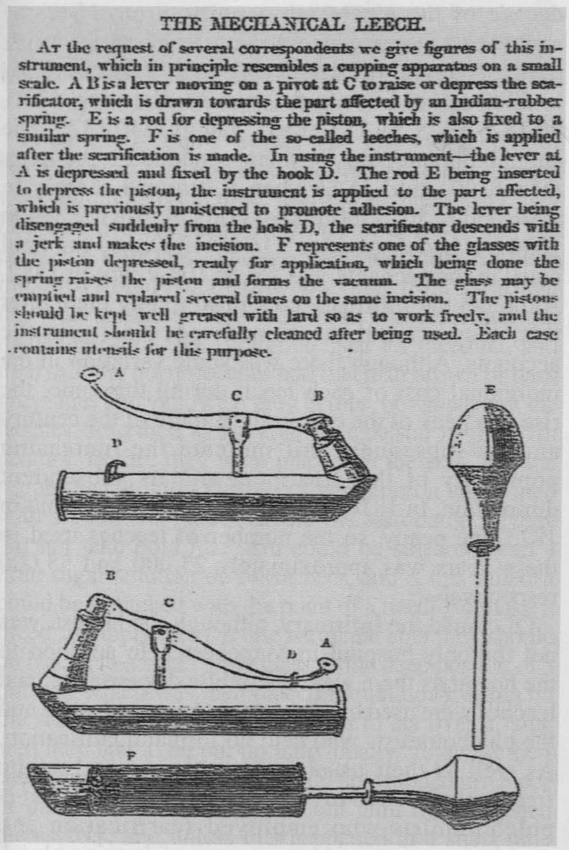
chester and Salford listed a number of 'cuppers and bleeders', and in 1829 there occurred, for the first time, an entry for a 'bleeder with leeches', Emma Twig.[36] In 1853 we find three bleeders with leeches who are also included in the list of six cuppers and bleeders.[37] This indicates that the use of leeches for bleeding became more popular towards the middle of the century among the general population as well as in the hospitals.

Although many hospitals maintained an aquarium that contained some leeches well into the twentieth century for treating local conditions such as black eyes, their use declined. However, a fresh demand for them arose later in the century. In 1960 two Slovenian surgeons published a paper describing their use in tissue flap surgery, and they were used by French surgeons in the mid-1970s for this purpose and also for reconnecting fingertips by microsurgery.[38] On 17 March 1982 *The Times* reported that leeches were being used in plastic surgery at Nottingham City Hospital to prevent the formation of blood clots that interfered with skin grafting.[39] On 23 May 1984 the *Manchester Evening News* reported that Wythenshawe Hospital was using leeches in plastic and microsurgery and the following year in Boston, USA, Dr Joseph Upton reattached the ear of a child, Guy Condelli, which had been bitten off by a dog.[40] Their use in such operations has now become routine.


THE MECHANICAL LEECH.

At the request of several correspondents we give figures of this instrument, which in principle resembles a cupping apparatus on a small scale. A B is a lever moving on a pivot at C to raise or depress the scarificator, which is drawn towards the part affected by an Indian-rubber spring. E is a rod for depressing the piston, which is also fixed to a similar spring. F is one of the so-called leeches, which is applied after the scarification is made. In using the instrument—the lever at A is depressed and fixed by the book D. The rod E being inserted to depress the piston, the instrument is applied to the part affected, which is previously moistened to promote adhesion. The lever being disengaged suddenly from the book D, the scarificator descends with a jerk and makes the incision. F represents one of the glasses with the piston depressed, ready for application, which being done the spring raises the piston and forms the vacuum. The glass may be emptied and replaced several times on the same incision. The pistons should be kept well greased with lard so as to work freely, and the instrument should be carefully cleaned after being used. Each case contains utensils for this purpose.

Figure 4. The Mechanical Leech (*Pharm J* 1849; 8(9): 426).

One frequently hears about history repeating itself, but few people realise that Johann Friedrich Dieffenbach (1792-1847) sometimes referred to as the 'Father of Plastic Surgery' because of his work in rhinoplasty and other reconstructive techniques, who was the Head Surgeon of the Charité-Krankenhaus, Berlin, described the use of leeches in 17 cases of reconstructive surgery carried out between 1827 and 1834. His records do not indicate that he considered their use in this way to be unusual, and it is known that Phillipe Frédéric Blandin (1798-1849) Surgeon of l'Hôpital Beaujon, Paris, used them in plastic surgery after 1837.[41] After this there do not seem to be any more reports of this practice.

The eminent doctor Pierre Charles Alexandre Louis pioneered the application of 'numerical' (i.e. statistical) evidence to his studies on bloodletting in the treatment of some inflammatory diseases. These were published in the 1830s and tended to show that the advantages of bleeding were not as great as had been believed. It is thought that this book was influential in the decline in the use of this therapy. Furthermore he stated 'that, wherever I have been able to compare the effect of general, with that of local bleeding by leeches, the superiority of the former has appeared to me demonstrated.'[42] It is possible that this may have had some effect in their ceasing to be used in plastic surgery.

Artificial or Mechanical Leeches

Possibly because of the shortage of medicinal leeches, several devices were developed in the 19th century that could be used to withdraw blood from wounds made by scarificators or lancets. One such, described in the *Pharmaceutical Journal* in 1849, is shown in Figure 4.

Conclusion

For more than two thousand years the medicinal leech has been used for therapeutic purposes, though the degree to which it has been employed has varied widely over this period. Recently their employment has received a fresh impetus due to the renewal of their use in plastic and microsurgery. Research is also progressing on the isolation of the different factors present in leech saliva for their use in cardiac conditions. Will the future introduce the synthesis of these drugs, and bring about another diminution or even a final cessation of the use of these fascinating creatures? Only time will tell.

Tailpiece

In *Curious Cures of Old Yorkshire*, we read that one doctor gave six leeches to a man's wife and told her to apply them to his stomach where he had a sore. It was unfortunate that she was not familiar with the word 'apply'. When the doctor asked her how her husband was, she said that he was better now, but that as he had had great difficulty in chewing the first one, she had boiled the rest and he had managed to swallow them.[43]

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The Museum of the Royal Pharmaceutical Society has launched *Domestic medicine chests*, an illustrated information sheet on the history of medicine chests, how they were made, how they were used and their contents.

The sheet gives some ideas about how the style and contents of a medicine chest can help to date it. It also explains the purpose of some of the stranger pieces of equipment that are sometimes found in medicine chests.

Briony Hudson, the Society's Keeper of the Museum Collections, commented that Medicine chests were often incredible time-capsules reflecting the ailments and treatments in a particular household. The Museum has medicine chests dating from the late eighteenth century to the early 1900s. This 16th sheet is available from the Museum and all are on the Society's website (www.rpsgb.org).

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840 Melton Road, Thurmaston, LEICESTER LE4 8BN

Founded 1967

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British Society for the History of Pharmacy

840 Melton Road, Thurmaston, Leicester, LE4 8BN
Tel: 0116 264 0083, Fax: 0116 264 0141, Email: bshp@associationhq.org.uk
Website: www.bshp.org

The British Society for the History of Pharmacy was formed in 1967 under the aegis of the Pharmaceutical Society of Great Britain, having originated from its History of Pharmacy Committee.

BSHP seeks to act as a focus for the development of all areas of the history of Pharmacy, from the works of the ancient apothecary to today's ever changing role of the community, hospital, wholesale or industrial pharmacist.

Aims

Promotion of historical studies related to pharmacy.
Advancement of knowledge and propagation of understanding of the history of pharmacy.
Publication of the research work of pharmaceutical historians.
Preservation of pharmaceutical artefacts and historic pharmacies.
Support for the work of relevant museums and offering advice on establishment of other pharmaceutical exhibits and on the preservation of pharmacies.
Co-operation with related professions and local historians on medico-pharmaceutical topics of mutual interest.

Pharmaceutical Historian

The *Pharmaceutical Historian* has been published since 1967, at first intermittently, but on a regular quarterly basis from 1972.

An index for the years 1967-1995 was published in 1998. An index for 1996-2000 was published with the December 2000 issue. Issues generally comprise 16 pages and cover.

Papers, short communications and letters in English on any aspect of the history of pharmacy are welcome and should be sent to the address above or by email to *bshpeditor@associationhq.org.uk*

Any illustrations are converted to monochrome for printing. Further details of requirements can be found on the website *www.bshp.org* under Publications.

Membership

Membership costs £20.00 per annum and includes:

Four issues of the *Pharmaceutical Historian*.

Regular meetings, with guest speakers, usually in November, February and May. (Many meetings are College of Pharmacy Practice accredited for post-graduate education requirement.)

Visits to places of historic interest, museums, collections, botanical gardens, etc.

Annual Conference, usually in March/April (but not 2005 because of International Congress).

Free use of Royal Pharmaceutical Society of Great Britain's library facilities for research.

Help in historical research and with the identification of artefacts.

Affiliation to the International Society for the History of Pharmacy (ISHP).

Affiliation to the British Society for the History of Medicine (BSHM).

Application forms are available from the Honorary Secretary at the address above or on *www.bshp.org*

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1978, 1979	Miss D Ann Hutton
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1989, 1990	Dr Melvin Earles
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1995, 1996	Mr Anthony C Morson
1997, 1998	Dr John A Hunt
1999	Mrs Enid Lucas-Smith
2000, 2001	Dr Peter M Worling
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PHARMACEUTICAL HISTORIAN

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840 Melton Road, Thurmaston, LEICESTER LE4 8BN

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Diary

Dates of meetings 2005
Wednesdays 9 February, 13 April (with AGM), 28 September, 16 November

22–25 June 2005 Edinburgh
37th International Congress of the International Society for the History of Pharmacy
The Congress will be organised by the BSHP. All members of BSHP are members of the ISHP. The BSHP will not be holding its usual Spring Conference in 2005. Brochure, abstract and registration forms have been sent to members and are available online at www.bshp.org Remember to book before 31 January.

1-4 September 2005
BSHM 21st Congress at Exeter. Details from Secretary.

Special Exhibition at the Museum of the History of Science, Oxford *Drug Trade: therapy, pharmacy and commerce in early-modern Europe* A free exhibition displaying the collection of early drug jars and herbals, at the Museum, Broad Street, Oxford from October 2004 to 13 March 2005. Further details from www.mhs.ox.ac.uk or 01865 277280.

Fifty years of the International Academy for the History of Pharmacy

Prof. Wolf-Dieter Mueller-Jahnke, Heidelberg

The International Academy for the History of Pharmacy – Académie Internationale d'Histoire de la Pharmacie – was founded in 1952. It was the brain-child of professor Dr Georg Edmund Dann from Kiel, Germany. At the congress of the International Society for the History of Pharmacy (ISHP) at Salzburg in 1951, Georg Edmund Dann (Figure 1) proposed to establish an 'International Academy for the History of Pharmacy'. He wanted to offer the new academy to George Urdang, professor of pharmacy history at the University of Madison, for his 70th birthday. For the

Figure 1: Georg Edmund Dann proposed the establishment of the International Academy for the History of Pharmacy.

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establishment of the academy, a committee under Dann's presidency was formed with Dr Dirk Arnold Wittop Koning from Amsterdam and Dr Pieter Hendrik Brans from Rotterdam.

The first impetus

On March 20th 1952 the committee addressed a circular to the most important pharmacy historians and invited them to join the academy. The letter read:

> Académie Internationale d'Histoire de la Pharmacie,
> the Hague and Rotterdam, the Netherlands,
> 20th March 1952.
>
> Professor Dr. George Urdang, University of Wisconsin (Madison, USA), without doubt one of the most important pharmacy historians, will celebrate his 70th birthday on June 13th this year. With his publications, Professor Urdang promoted the development of pharmacy history in all countries of the world. In order to continue his life's work, an 'Académie Internationale d'Histoire de la Pharmacie' is founded on the initiative of Georg Edmund Dann in the name of the most important pharmacy historians of the world. The goals of the academy can be recognized in its name and in conformity with the statutes enclosed in this letter.
>
> We ask you very cordially to become initial member of this world-wide institution, to fill in and send back the enclosed card. The establishment shall be a gift to professor Urdang on the occasion of his 70th birthday, and he shall have the honor to appoint the first members of the academy.
>
> We leave it to you to register on the attached card the money which you leave to the founders for establishment. If exchange restrictions should exist in your country, it is enough to hold this sum for the order of the Academy in your country; the payment is regulated later.
>
> Please send in the attached card before April 15th, 1952 even if you cannot make a contribution. In the name of the supervisors we remain sincerely yours
>
> G.E. Dann, Kronshagen-Kiel
> Dr. D.A. Wittop Koning, Amsterdam
> Dr. P.H. Brans, Rotterdam.

Limited number of members

From the beginning it was intended that each country was allowed to designate at the most two outstanding pharmacy historians (Table 1). Beyond that further pharmacy historians had been written down, so that the result was a 'store list', from which the 'Membres présumés' could be drawn. Some of these were taken up later, others were however not taken up.

Table 1: Founding countries of the academy (in alphabetical order)

Countries with one representative: Argentina, Brazil, Ecuador, Israel, Italy, Japan, Norway, USA
Countries with two representatives: Belgium, Denmark, Germany, Finland, France, Great Britain, Yugoslavia, the Netherlands, Austria, Peru, Sweden, Switzerland, Spain

It is quite interesting that the publishing house Dr. Julius Springer in Berlin, the ABDA (working group of German pharmacist federations) from the Federal Republic of Germany and the British Pharmaceutical Society in London made available a substantial sum for the establishment of the Academy.

Academy founded

To come to the actual establishment, the dean of the pharmacy department Dean Uhl was assigned to carry out the establishment act at a festive dinner on the occasion of Urdang's 70th birthday in Madison on June 13th, 1952. On the same day George Urdang (Figure 2) named the founding members who were informed with a circular. They were the first members to obtain a document and the academy's insignia.

Figure 2: George Urdang was the first president of the newly created academy.

Table 2: Number of representatives for today's members

1	Egypt, Chile, Finland, India, Japan, Croatia, Cuba, Norway, Portugal, Puerto Rico, Slovenia, Syria, Czech Republic
2	Australia, Denmark, the Netherlands, Austria, Sweden, Tunisia
3	Argentina, Greece, Poland, Romania
4	Hungary
5	Belgium, Canada, Switzerland
7	France, Great Britain
9	Spain
10	Italy
11	Germany, United States of America

The first president was George Urdang, assisted by the vice-presidents Georg Edmund Dann and Eugène Humbert Guitard (France). Pieter Hendrik Brans and

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Dirk Arnold Wittop Koning, both from the Netherlands, became secretary-general and treasurer. Dann, Wittop Koning and Brans worked out the first statute; it specified the establishment and the goals of the academy, the admission of new members and the official languages. The seat of the academy as a 'High Chamber' (Chambre haute) of the history of pharmacy was to be the Hague in the Netherlands. Here the members wanted to establish their own library, to which each member should send its scientific work.

Thus, the establishment of the academy was carried out. It found good acceptance with the pharmacy historians of the whole world, in particular at the International Society for the History of Pharmacy.

At the same time, the 'George-Urdang medal' was also brought into being on June 13th 1952, which should remind us of the outstanding achievements of this pharmacy historian. Each member of the academy had – and still has today – the right to suggest candidates, whereby the suggestions should be directed to the 'American Institute of the History of Pharmacy' created by Urdang. The first committee for awarding the Urdang medal consisted of Sir H.N. Linstead (London) as a president, Glenn Sonnedecker (Madison, Wisconsin) as a secretary, Maurice Bouvet (Paris), Georg Edmund Dann (Kiel) and R. Folch Andreu as members.

The present statute

The present statute of the Académie Internationale d'Histoire de la Pharmacie covers ten paragraphs, which have been changed several times. The statute regulates the number of members of the Academy, their status and the candidacy of new members. According to paragraph 5, the Academy admits both full and emeritus members.

The number of full members is limited to six per country up to 30 million inhabitants. If a country's population exceeds this limit, another member can be coopted for every further 50 million inhabitants. At the age of 70 full members will become emeritus members, but they keep all rights. However, the emeritus members may not be counted in the total number of the full members.

If a country cannot fill the seats of the full members or if a member is deceased, has resigned or become an emeritus member, there can be a new election. The rules for the presentation of a new member are strict: Each candidacy must be submitted by at least two members of the Academy. It is to be handed over to the Secretary-General with a curriculum vitae and a list of the scientific work, who passes this information on to all members of the executive committee. The candidacy is published in the Academy's *Communications*. If there is no objection within three months, the candidate is appointed as a full member.

The officers of the academy's executive committee have been fixed in composition since 1952: one president, two vice-presidents, a secretary-general and a treasurer. All members of the executive committee work on an honorary basis.

The Académie Internationale d'Histoire de la Pharmacie meets at a regular interval of two years, since 1970 primarily in the context of the conferences of the ISHP. During the solemn meeting (Séance solenelle) the new members are accepted and granted the document and the insignia of the academy (Figure 3). Paragraph 4 of the statute determines that the academy members are to participate in a scientific exchange, which has taken place in the *Communications* since 1983. According to paragraph 9, any payments of the members to the academy are voluntary.

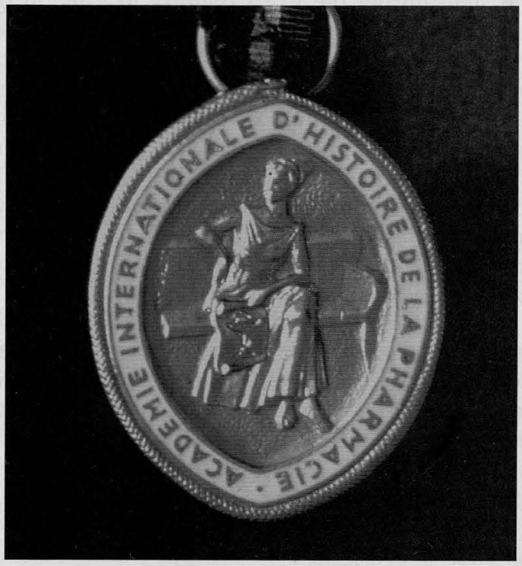

Figure 3: The academy's insignia.

Movements in the executive committee

It is interesting to look at the number of today's countries and the number of their members (Table 2). There are 32 countries with altogether 110 members, though this does not show the numbers of full and emeritus members. It would be extraordinarily interesting, if one could pursue the member change within the individual countries in detail. This can only be reconstructed for the executive committee. Table 3 shows the presidents, vice-presidents, secretaries and treasurers from 1953 until today.

First of all it is striking that it is not the states with large areas which dominate the executive committee: above all the Netherlands and Belgium, Switzerland, Greece and Hungary are represented. However, the states with a tradition of pharmacy history are not missing, such as the United States of America, France, Spain and Germany. The position of the treasurer was occupied until 1960 by the Dutchman Dirk Arnold Wittop Koning, then by a German and two Scandinavians; since 1970 it has been constantly in the hands of Americans: John Parascandola, George Griffenhagen and William H. Helfand. From 1983 until today the editorship of the *Communications* has been the responsibility of the Frenchman Pierre Julien.

In accordance with the statutes, the academy members

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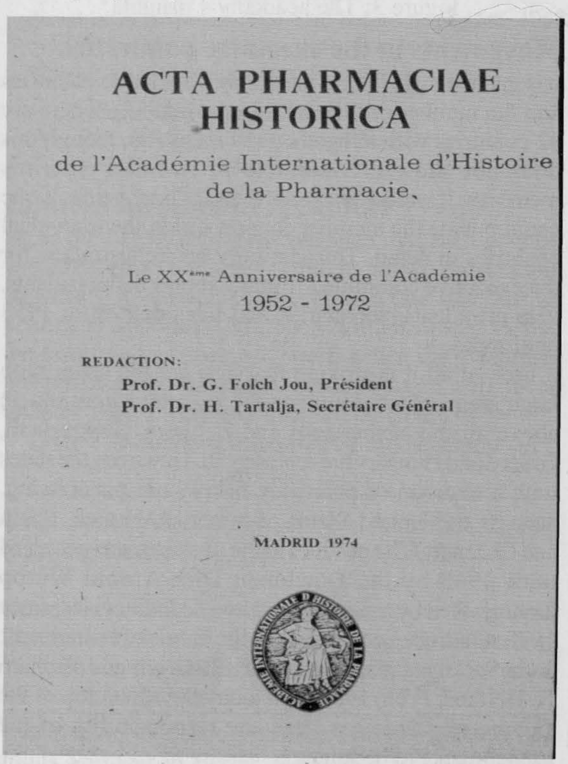
meet at regular intervals in the Séance solenelle. The first official meeting took place 1953 in Paris during the congress of the International Pharmaceutical Federation (FIP) on September 17th in the famous Salle des Actes of the faculty for pharmacy. In 1954, the academy attended the International Congress for the History of Pharmacy on the occasion of the 525th anniversary of the Nobile Collegio Chemico Pharmaceutico in Rome; the meeting took place on September 7th in the Palazzo Barbarini.

In the following year the festive academy meeting was held during the FIP Congress in London on September 20th. In 1956 and 1957, the members met at the Congress of the International History of Pharmacy Society in Luzern and Heidelberg. The Academy meetings took place in the context of the Congress of the International History of Pharmacy in 1958 (Padua and Venice) and 1959 (Dubrovnik). In 1961, this congress again hosted the Academy in Innsbruck, where the members commemorated the Academy's first president George Urdang, who had died in Madison on June 27th 1960 at the age of 78 years.

In 1962, the FIP hosted the Academy in Vienna, in the subsequent year the host was the International Congress in Rotterdam. In 1965 and 1967, the academy met at the International Congress for the History of Pharmacy in London and Athens, in 1966 and 1968 at the FIP congress in Madrid and Geneva. The change between the organisations continued: 1971 with the ISHP, 1972 with the FIP in Lisbon and 1973 at the congress of the ISHP in Paris. Then, the academy made a habit of meeting in principle in the context of the ISHP.


ACTA PHARMACIAE HISTORICA

de l'Académie Internationale d'Histoire de la Pharmacie.

Le XXème Anniversaire de l'Académie

1952 - 1972

REDACTION:

Prof. Dr. G. Folch Jou, Président

Prof. Dr. H. Tartalja, Secrétaire Général

MADRID 1974

Figure 4: The *Acta Historica* of 1974

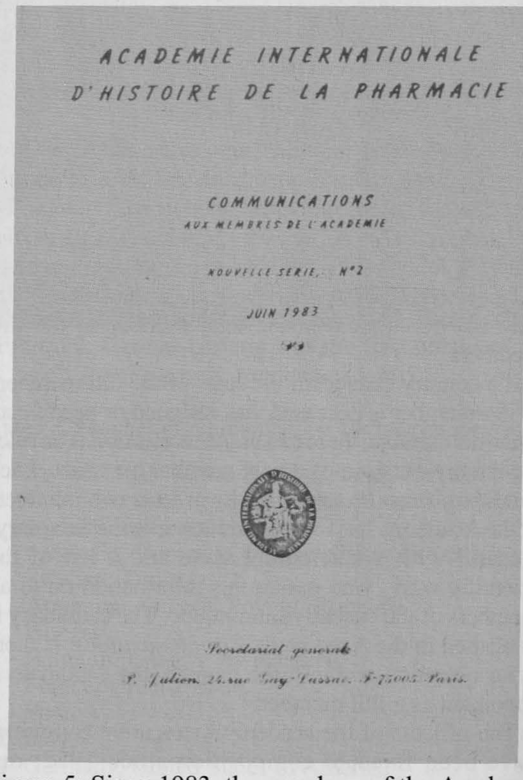
Archives and library missing

In 1959, a committee met under the direction of Brans, Dann, Bouvet and Vitolo, in order to establish an 'Academy House' (Maison l'Académie d'Histoire de la Pharmacie). The house was to be established in the Hague, the legal seat of the Academy; the solemn intention was sealed on December 30th 1959 in Rotterdam before the mayor J.V. de Heer. As the academy always lacked the necessary money in order to build or rent such a house, this plan remained unfulfilled.

A further question, which was raised again and again, especially as a permanent seat of the academy could not be realised, was the question of the academy's archives and library.

In 1973, there was a conflict with the secretary-general Brans, who had administered the archives until then, but in the meantime had been voted out. After long hesitation, Brans agreed that professor Dr Rudolf Schmitz, founder and director of the Institute for the History of Pharmacy at the University of Marburg on Lahn, should take the documents and books of the academy library to his institute.

Brans was obliged to hand over the archives and library; Schmitz wanted to bring the material to Marburg in his private car. Apparently, this did not take place, because Schmitz, whose assistant the author was at this time, reported of the order, but not of its execution. It is unknown where the archives and library remain


ACADEMIE INTERNATIONALE D'HISTOIRE DE LA PHARMACIE

COMMUNICATIONS

AUX MEMBRES DE L'ACADEMIE

NOUVELLE SERIE, N°2

JUIN 1983

Secrétariat général

P. Julien. 24 rue Gay-Lussac. F-75005 Paris.

Figure 5: Since 1983, the members of the Academy have been in scientific exchange through the *Communications.*

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today. An inquiry to professor Dr Armin Wankmueller at Tübingen did not bring any new information either.

The ISHP statute had also planned a library, which had to be incorporated into the 'Central Pharmaceutical Library' directed for a long time by Wankmueller at the Federal State Library of Wuerttemberg in Stuttgart. Since the ISHP also obliged its members to deliver a copy of their writings to their library, there was only a moderate interest in establishing a second international library, in which second copies were kept.

First publications

The publications of the academy represent a bond between the different members. In 1959, the first volume of the *Acta Pharmaciae Historica de l'Académie Internationale d'Histoire de la Pharmacie* was published, followed in 1961 by a second volume, which contained a biobibliography of George Urdang written by George Wolf. In 1962 and 1963 the third and fourth volume appeared, followed in 1968 by the fifth and last volume.

On the occasion of the academy's 20th anniversary, a volume.of *Acta Pharmaciae Historica* was published which had been drawn up by Guillermo Folch Jou as president and Hrvoje Tartalja as a secretary-general (Figure 4). This volume described the history of the establishment and the early days of the academy up to 1973, followed by biobibliographies of the full and emeritus members with their photographs. In addition to the *Acta* the secretaries-general, Brans and Fehlmann, had published a newspaper under the title *Avis* at irregular intervals.

Active exchange among the members

In 1983, at the time when Pierre Julien was secretary-general, the *Communications de l'Académie Internationale d'Histoire de la Pharmacie* were brought out as *Nouvelle Série* (Figure 5). These appeared twice a year, primarily in French. Under the presidency of professor Glenn Sonnedecker of the University of Wisconsin the *Communications* became bilingual in 1984: an English translation was added to the French version.

According to the statute, the language of the Academy is French but English, German and Spanish summaries

Table 3: Officers of the Academy from 1953 to date

Year	President	Vice-presidents	Secretary	Treasurer
1952	G. Urdang (honorary president 1955)	G.E Dann E.H. Guitard	P.H. Brans (honorary Secretary-General 1975)	D.A. Wittop Koning
1955	G.E Dann (hon. president 1970)	M. Bouvet G. Folch Jou	P.H. Brans	D.A. Wittop Koning
1960				E. Schubiger
1961				C.C. Petersen (not Academy member)
1963	G.E Dann	M. Bouvet G. Folch Jou	P.H. Brans	C.C. Petersen
1966				K. Jespersen (not Academy member)
1970	G. Folch Jou	G. Sonnedecker	P.H. Brans	G. Griffenhagen
1971		W. Schneider	H. Tartalja	
1975	D.A. Wittop Koning (hon. president 1985)	G. Sonnedecker W. Schneider	H.R. Fehlmann	G. Griffenhagen
1981	D.A. Wittop Koning	W.-H. Hein H.R. Fehlmann	P. Julien	J. Parascandola
1983	G. Sonnedecker (hon. president 1991)	W.-H. Hein J.L. Valverde Lopez	P. Julien	J. Parascandola
1985	G. Sonnedecker	W.-H. Hein J.L. Valverde	P. Julien	J. Parascandola
1989	G. Sonnedecker	P. Julien J.L. Valverde	B. Mattelaer	G. Griffenhagen
1991	K. Zalai (hon. president 1995)	M.C. Francés Causapé P. Julien (hon. president 1997)	B. Mattelaer	G. Griffenhagen
1995	M.C. Francés Causapé	P. Julien W.-D. Müller-Jahnke	B. Mattelaer	G. Griffenhagen
1997	M.C. Francés Causapé	F. Ledermann B. Mattelaer	W.-D. Müller-Jahnke	W.H. Helfand
2001	W.-D. Müller-Jahnke	F. Ledermann O. Lafont	E. Varella	W.H. Helfand

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can be added. However, the multilingualism has gained no acceptance, because the volumes would have become too extensive. Nevertheless, the speech of the new president as well as the report of the treasurer have been printed in French, German and English if possible.

The first volume of the *Communications* comprised seven numbers and was completed in December 1985 with an index. The second volume – the *Nouvelle Série* is consecutively numbered – started with number 8 in June 1986 and ended with number 16 in December 1989, when an index for volume 2 was added. The third volume started in July 1990 with number 17 and ended with number 32 in December 1997, again accompanied by an index.

Together with the solemn meetings, the *Communications* represent a cornerstone of the Academy. They have a standard pattern. First the life of the academy ('vie de l'Académie') is described, where obituaries are also published. Then the 'Nouvelles des membres de l'académie' follow, with a survey of general information on the academy members. The column 'New historical publications of the academy members (Récentes publications historiques des membres de l'Académie) proves to be an important bibliography. And finally the candidacies for new full academy members are published, whose choice is confirmed six months later.

50th Anniversary in Nice

The International Academy for the History of Pharmacy celebrated its anniversary in the context of the 62nd FIP Congress in Nice. The 'Working Group: History of Pharmacy' was organised by Leif Eklund (Sweden) and professor Dr François Ledermann (Switzerland) in the name of the ISHP on September 4th, 2002. The ten lectures, mainly given in English, covered the history of pharmacy in the Mediterranean area, for example in France (J. Gravé, France), the term 'Dispensation' (J.-P. Bénezét, France), the history of the olive tree (M. Haerdelius, Sweden/France) or the training of English pharmacists on the Côte d'Azur (S. Anderson, Great Britain). The president's lecture was dedicated to the history of this Academy.

This short overview shows that the academy has progressed well in the first fifty years of its existence. One may safely assert that it still brings together today the prominent pharmacy historians of the world.

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St Margaret's Well at Binsey near Oxford : the Treacle Well of *Alice in Wonderland*

Dr J T Hughes

The most famous tea-party in English literature must be that in *Alice's Adventures in Wonderland*, by Lewis Carroll (Figure 1).[1] It appears in chapter VII entitled 'A Mad Tea-Party', an addition to the manuscript of *Alice's Adventures Underground*.[2] Alice seats herself at the table with the March Hare and the Mad Hatter, who awaken the sleeping Dormouse, and request a story:

> 'Once upon a time there were three little sisters', the Dormouse began in a great hurry; 'and their names were Elsie, Lacie and Tillie; and they lived at the bottom of a well. 'What did they live on?' said Alice, who always took a great interest in questions of eating and drinking. 'They lived on treacle', said the Dormouse, after thinking a minute or two.

The next few lines are concerned with the serving of tea and bread and butter, rather discourteously, to Alice, who returns to questioning the Dormouse.

> 'Why did they live at the bottom of a well?' The Dormouse thought for a minute or two and said 'It was a treacle well'. 'There's no such thing!' Alice was beginning very angrily, but the Hatter and the March Hare went 'Sh! Sh!' and the Dormouse sulkily remarked, 'If you can't be civil, you'd better finish the story for yourself'. 'No! please go on!' Alice said very humbly. 'I won't interrupt you again. I dare say there may be one.' 'One indeed!' said the Dormouse indignantly. However he consented to go on.

All the overtly fictional writings of Lewis Carroll are based on real people, actual places, and events at which the author was present, or, of which he was familiar. Carroll had seen Landseer's Titania and commented on the white rabbit in the painting. The 'Mad Hatter' was Theophilus Carter, an eccentric Oxford furniture dealer, who wore a large top hat. Alice Liddell was the daughter of the Dean of Oxford Cathedral, who was the head of the College of Christ Church. Lewis Carroll – the Dormouse – was the Revd Lutwidge Dodgson, a mathematics don at Christ Church.[3]

The Golden Afternoon in 1862

Alice's Adventures in Wonderland arose from a story told to the Dean's children, and begins with the poem 'All in a golden afternoon', describing Friday July 4th, 1862.[4 5] Lewis Carroll had arranged a picnic with a friend, the Revd Robinson Duckworth, a Fellow of Trinity College, and the 'Duck' in the story.[6] Their passengers were the three daughters of the Dean of Christ Church, who were the sisters living in the treacle well. Elsie, the eldest, called 'Prima' in the poem, was Lorina Charlotte, that is: LC. 'Secunda' was the famous Alice Pleasance Liddell, who, in the well, was Lacie, an anagram of Alice. 'Tertia', whose real name was Edith, but was nicknamed Matilda, became Tillie in the story. The

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Figure 1. The illustration for 'A Mad Tea-Party' by John Tenniel. Author's collection.

party were rowed from Folly Bridge to Godstow, where they disembarked for the picnic. They passed, on the South bank of the river, the site of the Holy Well in the churchyard of St Margaret's, at Binsey. Possibly they landed and looked at the well, and the Revd Dodgson explained why it was called a treacle well. In the tale, Alice said '... I dare say there may be one'. 'One indeed', said the Dormouse (Dodgson) indignantly. He may have explained how there were many treacle wells in England, of which this was an example. But, what is the history of the well, and why may we call it a treacle well?

St Frideswide and Binsey

St Margaret's well (Figure 2) is associated with St Frideswide, whose death is dated as 735 AD.[7] In the eighth century, Oxford had minor importance as a crossing place of the river Thames, which was the boundary between the Saxon kingdoms of Wessex and Mercia, of which, Mercia was the stronger. The land on either side of the Thames was held by the Mercian King, Aethelbald. An account of the life of St Frideswide must balance historical fact and legend, as all relevant documents are from several hundred years later. She is recorded in a list of saints of England written in the early eleventh century, which states 'St Frideswide rests at Oxford'.[8]

William of Malmesbury, writing soon after 1125, describes Frideswide as a king's daughter, sought in marriage by a king, from whom she fled, arriving by night into the town of Oxford.[9] Her prayers for protection were answered when the pursuing king,

Figure 2. St Margaret's Well today. A recent photograph by J.M. Dudley. Author's collection.

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about to enter the city, was struck blind (Figure 3). Frideswide subsequently founded a monastery [AD 727], where she lived for the rest of her life, and where she was buried. In the reign of King Aethelred, the fugitive Danes sought refuge in this monastery, and perished when the building was set alight [on St Brice's day, 1002]. Two years later, the monastery was restored and endowed with new possessions.

Figure 3. Frideswide, surrounded by her nuns, taking refuge from King Algar, who is struck blind. Reproduced, as is figure 4, from Blair J. *Saint Frideswide, Patron of Oxford*, Reference 7c.

By the end of the thirteenth century, details had been added, the veracity of which is uncertain.[10] Frideswide was identified as the daughter of King Didanus and his wife Safrida, her unwelcome wooer was King Algar, and the place where she settled and founded her monastery in 727 was the woodland of Thornbury, subsequently known as Binsey. This legend has confirmation in the charter granted by King Aethelred in 1004 to the church, where lay the remains of Frideswide.[11]

Pilgrimages were made to the burial place of Frideswide, and in 1180 her remains were moved within what was now a Norman church (Figure 4).[12] In 1269 the relics were contained in a shrine, which was visited by Henry III, and, in 1289, they were transferred into a feretory of precious metals resting on a marble base, and visited by Edward I. Frideswide was canonised in 1481 and the pilgrimages continued. Of the three saints of popular pilgrimages in England – Frideswide d. 735, Swithin d. 862, and Thomas a Becket d. 1170 – Frideswide was the earliest. Catherine of Aragon visited the shrine at Binsey but in 1538 her husband, Henry VIII, caused the destruction of the shrine. Today the remains of St Frideswide, within a modern shrine, are in Christ Church Cathedral. St Margaret's church was restored in 1875, and repaired in 1933 and 1963.

Holy and Healing Wells: St Margaret's Well at Binsey

Holy and healing wells abound in the British Isles, as evidenced by many surviving wells locally famous for these qualities. There are many accounts.[13] Hope described 19 such wells in and around Oxford including Aristotle's well, Holywell, Walton well, and St Bartholomew's well, the names of which survive today. But the most famous in Oxford is St Margaret's Well at Binsey, linked to the miraculous cures of Frideswide, the first being the restoration of sight to King Algar. Miracles became associated with the water of the well at Binsey, which survives as a holy and healing well. These wells are part of an ancient culture of reverence for water, whether seas, lakes, rivers, streams or springs. In ancient Egypt the Nile was considered sacred, as is the Ganges today. In England, most rivers had identified spirits. Queen (the goddess) Sabrina is associated with the Severn and King (the god) Ludd with the Thames.[14] The Bible contains many references to the sanctity of water, as we are reminded by the ceremony of baptism.

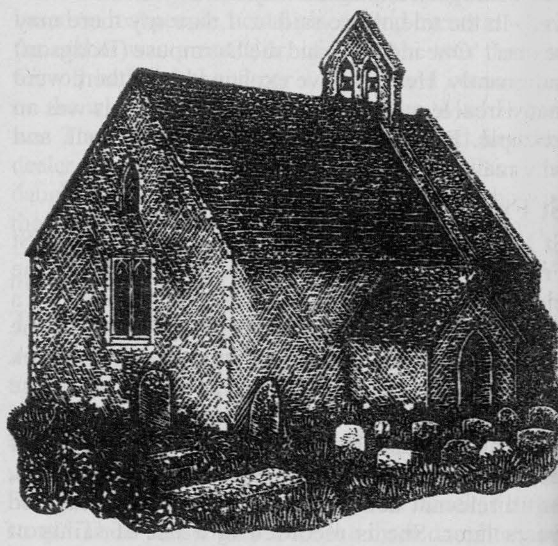

Figure 4. St Margaret's Church, Binsey, Oxford.

Treacle and Medieval Theriac

Why a treacle well? This was a common name for a healing well, and local place names still describe treacle wells and treacle mines.[15] The current use of the word treacle for the black product of sugar cane

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from the West Indies dates only from the 17th century. The earlier meaning of a therapeutic is much older.[16] Galen, a Greek physician born *c.* AD 130 in Pergamon, Asia Minor, who studied at Alexandria and practised in Rome, wrote extensively on *theriake*.[17] The Latin is *theriaca*. The Greek adjective *theriake* is derived from *therion*, 'a wild or venomous animal', and modified a noun to describe an antidote to the bite of a wild beast.

Combating poison was the earliest use and there is a record of a gift of *theriaca* from the Patriarch of Jerusalem to Alfred the Great.[18] Faith in combating poisoning persisted into the Tudor period, and Queen Elizabeth regularly consumed *theriaca*.[19] Later the meaning was extended to a remedy or balm. The Middle English was tryacle or triacle, from which arises treacle. That this word was in common use in the sixteenth century is evident from the 'treacle' bible, also called the 'Bishops' bible, an early translation of the Bible into English.[20] *Jeremiah*, chapter 8, verse 22 reads:

> Is there not triacle at Gilead: Is there no Phuition there: why then is not the health of my people recovered.

And the word persists today in the names of plants. Herbs that had the reputation of healing have treacle as an adjective in their common name, and so we have: treacle clover, garlick, mustard, rue and wormseed, of which the best known is treacle mustard – *Erysimum cheiranthoides*.

Theriaca, a first resort of physicians, was one of the five sovereign remedies.[21] In 1665, when the Great Plague broke out in London, King Charles II requested help from the Royal College of Physicians. In their written advice, of internal remedies, the first mentioned was London treacle.[22] The composition of *theriaca* varied according to the place of manufacture giving us, amongst others, treacle of Flanders, Genoa, London, Rome, Strasbourg, and Venice. Figure 5 depicts the ceremonial preparation of *theriaca* in Strasbourg at the beginning of the sixteenth century. There were many – sometimes fifty – ingredients, the formulation often being secret, but importantly including the flesh of a viper. Which viper was controversial. Pliny had insisted that European vipers were ineffective, but this was denied by Nicolas Leonicenus, of Ferrara, in publications dated 1497 and 1506.[23] In seventeenth century England, the ingredients of *theriaca* may be investigated in the Pharmacopoeias of the Royal College of Physicians, the first of which appeared in 1618.[24] Successive editions appeared and a translation with comments was made by Nicholas Culpeper.[25] The extensive importation of *theriaca* has been researched.[26]

Figure 5. Preparation of theriac at Strasbourg, seen in a woodcut in Hieronymus Brunschwig's *Liber de arte distilandi*, 1512. From a copy in the Wellcome Library for the History & Understanding of Medicine, London.

Tin-enamelled earthenware (delftware) was made in London from the end of the sixteenth century by Flemish potters, and their jars were used by druggists and apothecaries.[27] By the middle of the seventeenth century, inscribed jars were available, adding evidence of the use of *theriaca*, which persisted into the eighteenth century.[28] Figure 6 illustrates two jars from the Wellcome Museum in London. On the right is an eighteenth century English blue and white jar inscribed: *Theriac : Andromachi*, from the much used formula of Andromachus, the physician of Nero. On the left is a French polychrome drug jar for *theriaca*, much used in France and especially in Montpellier.[29]

The Treacle Well at Binsey

Due to the musings of Lewis Carroll, the idea of a treacle well is known world wide, but not the reality

Figure 6. Eighteenth century drug jars in the Wellcome Historical Medical Museum: a French Polychrome jar for Theriac, and an English blue and white jar for Theriac Andromachi.

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behind the fiction. A well whose water is known to effect cures may be called a treacle well, and by this name the well at Binsey is still known. Children are taken to the well and, with a jam jar at the end of a string, invited to draw treacle. They may be disappointed, but they are literally drawing from the Treacle Well at Binsey, near Oxford.

Acknowledgements

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Are scientific discoveries the result of good luck? An analysis of some pharmaceutical discoveries between 1920 and 1945

Dr Brian P. Block

> 'How would it be' said Pooh slowly, 'if as soon as we're out of sight of this Pit, we try to find it again?' 'What's the good of that?' said Rabbit. 'Well', said Pooh, 'we keep looking for Home and not finding it, so I thought that if we looked for this pit, we'd be sure to not find it, which would be a Good Thing, because then we might find something that we *weren't* looking for, which might be just what we *were* looking for, really'.
>
> A.A.Milne *The House at Pooh Corner*

Low-lying, damp localities with cold climates give rise to rheumatic conditions: such is the habitat of willows, therefore Maclagan searched willows (Salicaceae) for a remedy. Using extract of the bark, which he called 'salicin', his first case in November 1874 received 12 grains every three hours and in two days there was a reduction in temperature from 102.8F to 99.6F and the pain and swelling of the joints abated. On the following day the pain had gone and the temperature was normal. After testing eight patients with similar results he concluded that salicin was a valuable remedy in the treatment of acute rheumatism.[1]

This was an early example of getting the right result for the wrong reason; after all, cinchona trees were not indigenous to areas where malaria prevailed. Moreover, the efficacy of powdered willow bark for treating 'ague' was discovered by the vicar of Chipping Norton a century earlier.[2]

In the twentieth century there have been a number of major discoveries in the field of medicinal drugs and in some cases there appears to have been a large element of luck accompanying the discoveries. It is not the purpose of this paper to produce an exhaustive survey of such instances but rather to select a few major examples and to examine to what an extent chance played a major role. On the evidence of this survey I shall show that luck does play a part but that it is necessary for the scientist involved to recognise the lucky break, to have the necessary skill to exploit it and the post-discovery back-up to make the commodity useful. Many more scientists must have been lucky but those that lacked this skill have faded into obscurity. I shall seek to show that luck alone is not enough. For a successful outcome there must be, following the luck, teamwork and specialist development.

Insulin

When one thinks of the discovery of insulin the names Banting and Best spring to mind, even though it was Banting and MacLeod who were awarded the Nobel Prize, and it was the chemist Collip who solved the problem of toxicity.

Fred Banting was a part-time general practitioner and part time demonstrator at an Institute in London, Ontario, when he read in the November 1920 edition of *Surgery, Gynaecology and Obstetrics* an article by Moses Barron showing that degenerative changes occur in the pancreas when the pancreatic duct is ligatured. Banting had the idea that after degeneration the Islets of Langerhans alone would remain, from which an anti-diabetic extract could be made.[3] There were no facilities for research where Banting worked so he went to his *alma mater* in Toronto to discuss his idea with Professor MacLeod and to ask if he could have some laboratory accommodation. MacLeod agreed but Banting wanted to think it over.

Early in 1921 Fred Banting's first stroke of luck occurred. He was frustrated and desparate. He heard of an application for a medical officer to accompany an expedition to the Arctic to search for oil.[4]

> I was in desperate circumstances. I liked the thought of a trip to the North country. The possibility of research seemed remote. I tossed a coin – 3 out of 5 – heads I continue to do research, tails I go to the Arctic to search for oil. Tails won.[5]

In the end the expedition decided not to take an M.O. and Banting continued his research. He finally arrived in Toronto in May 1921. MacLeod gave him the use of a laboratory for 8 weeks, and ten dogs. Charles Best, a recent graduate, was to be his assistant, although his precise standing was later hotly disputed.[6] Banting had little knowledge of laboratory procedure or of previous work on the subject whereas MacLeod had been working in the field for eighteen years. Before leaving for the UK MacLeod gave Banting a list of references, considerable practical advice and suggested freezing the pancreas and extracting it at the lowest possible temperature.

Although Barron's observation was right, Banting's deduction was wrong, for there was no need to ligature the pancreas since the pancreatic enzymes do not destroy insulin, which, according to Pratt, had been shown by Heidenhain as early as 1875. Even MacLeod went along with this erroneous view referring to the 'powerful ferment of the intact pancreas' (in *Encyclopaedia Britannica* 1942).[7] Sobolen had also said that tying the pancreatic duct was a means of isolating the islets.[8]

It was Best's turn for luck next. He was one of two graduates assigned to paid work during the summer vacation with Banting. Best won a coin toss with the other graduate student, EC Noble, to see who would work first, and later, with Noble's approval, he stayed with Banting for the duration. Had Best stood down it is possible that Banting and Noble might have been known as the discoverers of insulin. After an initial quarrelling about Best's methods he and Banting settled down and worked amicably.

In August 1921 MacLeod, who was in Scotland, received a Report from Banting and Best that they had obtained a fall in blood sugar following injections of their extract. MacLeod replied that they should eliminate the dilution of blood as a cause of the lowered sugar level.[9]

By the time that MacLeod returned to Toronto at

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the beginning of September Banting and Best had cracked the main problems and had produced a pancreatic extract, first from ligatured pancreases and later from the pancreas of foetal calves, that consistently lowered the blood sugar of depancreatised dogs. They asked for better facilities, Banting threatening that if he did not get them he would apply to the Rockefeller Institute or the Mayo Clinic; but MacLeod immediately recognised that Banting's idea had borne fruit and switched the resources of the department to insulin.

By December 1921, although Banting and Best had shown conclusively that their extract would lower the blood sugar of depancreatised dogs they had not tested their extract on patients. When they did a few weeks later, the site of the injections formed aseptic abscesses and the patients developed fever. The German scientist Zuelzer had also demonstrated that his extract diminished glycosurea and acidosis in depancreatised dogs and in eight cases of diabetes mellitis; but his extract was toxic too. Banting admitted that Zuelzer's early results with patients were better than theirs.[10]

MacLeod suggested an air evacuation method for the removal of alcohol to concentrate the extract and Collip, a chemist on sabbatical, was invited (by Banting, according to MacLeod) to collaborate in the preparation of pure extracts.

It was only after Collip was added to the team – and reported to MacLeod every day in January 1922 – that a non-toxic extract was prepared, basically by precipitating the insulin with 95% ethanol, leaving the toxic products in solution. This was the extract that was first used in human diabetics.

It was during the meeting at New Haven, Connecticut, where Banting first presented their results, that GHA Clowes, Director of Research at Lilly, contacted MacLeod offering to collaborate with Toronto.[11] Attempts by the Toronto team to produce insulin on a large scale had failed so that a pharmaceutical company with facilities and know-how was needed if insulin were to be widely available. Lilly, already with a number of gland-derived substances on their list, was ideal. MacLeod kept on putting off Clowes' overtures, wishing Toronto to retain all the credit, but eventually, on 30 May 1922 an agreement between Toronto and Lilly was made and Lilly invested $250,000 to get large-scale production going. George Walden, a chemist at Lilly, was brought in to refashion insulin extraction; he used isoelectric precipitation which increased the potency and the yield of insulin.[12]

Banting based his claim for precedence on having had the idea on which the research was based. He said there was no practical help from MacLeod or Collip, with whom he frequently quarrelled. Banting gave Best credit but never credited Best with ideas or proposals that advanced the research. There is documentary evidence of the 1921-22 research that supports the view that Best was little more than a student helper, and this undermines his own view of his role. Years later, Feasby, who was a close friend of Best's and his biographer, wrote a rebuttal to Pratt's reappraisal (by which time Pratt was already dead), claiming that Best was not a 'junior medical student' although he was only 22.[13] But Best was not medically qualified and Banting was 30 years old and had served in the Canadian army with distinction, winning the Military Cross. However, there can be little doubt that the contributions of MacLeod and Collip were vital. When MacLeod and Banting were awarded the Nobel Prize, MacLeod shared his half of the money with Collip and Banting shared his with Best, but for the rest of his life Best believed that he should have shared the Prize. Collip kept his own counsel.[14]

There has been much argument concerning the respective roles of Banting, Best and Collip, but MacLeod has remained a shadowy figure, seen by some as as encroaching in the glory of Banting and Best as the senior who stole some of the credit from his juniors.[15] At one point Banting complained to the university authorities that MacLeod was stealing his credit, but after an interview with them, apologised to MacLeod, saying he had misunderstood his actions. However, MacLeod declined an offer from Banting and Best to add his name to the first published paper on their work saying that the full credit was theirs, and agreed that in six subsequent publications Banting and Best would be the first names. He presented the work on behalf of the group to the meeting of the Association of American Physicians in Washington with their unanimous consent as he, as professor and department head, would add weight. And in his paper to the *British Medical Journal* he wrote, 'to Dr F.G. Banting is due the credit [for undertaking] to see whether extracts of the degenerated [by ligation] gland' would lead to more certain results than those of earlier workers.[16] Best is named as Banting's collaborator, as were Collip, Noble, Hepburn and Latchford and he cited as a preliminary paper that of Banting, Best, Collip, Campbell and Fletcher.[17] His own contribution is not mentioned.

After MacLeod died in 1935 Banting, who became Sir Frederick the year before, became head of the department of Medical Research at the University of Toronto where the Banting Institute had been set up. By 1940 Best was head of the Dept of Physiology and would have liked a similar 'Best Institute'.

Then luck entered their lives again, but luck comes as both good and bad. In the winter of 1940-41 Best lobbied to be the next medical expert in line for a liaison mission to wartime Britain. Then he suddenly announced that he could not go and an exasperated Banting, angry with Best, decided he would make the trip himself. The plane crashed in Newfoundland and Banting was killed. Although it was well known that Banting did not want his university appointment to be inherited by Best if anything happened to him ('I'll turn in my grave if that son of a bitch gets it') Banting's chair and control of the department were given to Best.

Collip always refused to enter into the controversies of who had been most instrumental in discovering insulin – it should clearly have been MacLeod, Banting,

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Best and Collip – but with Banting and MacLeod both dead and Collip a 'non-combatant' Best had an unobstructed field in which to re-write the history of the discovery of insulin with himself as the main star.[18]

Despite repeated nominations from none other than Sir Henry Dale, Best was never awarded the Nobel Prize, but the Best Institute was opened in 1953 with Dale as the principal speaker. He said then that Banting and Best had worked in a deserted department during the vacation [in 1921] and that their work was virtually completed by the time MacLeod returned from Scotland.

However, the personal luck that befell them, good for Best and mixed for Banting, was not the only kind. They were lucky in their science, too, for what they achieved had largely been done before. There had been much early work on diabetes and the pancreas by Zuelzer and others.[19]

Georg Ludwig Zuezler was born in 1870 and in 1893 became a doctor of medicine and surgery. At the beginning of the 1900s he was working on diabetes and in 1907 introduced his theory of antagonism of 'Adrenalin–insulin auf und kamauf diesem Wege zur Darstellung seines als *Acomatol* antidiabetisch wirksamen Pankreasextraktes'. [*The antagonism of adrenalin–insulin which opened up this route to display the effective antidiabetic pancreatic extract as* Acomatol]. Zuelzer's problem was that he was unable to find a pancreatic extract that would lower the blood sugar level in dogs without killing them; the dogs died of insulin convulsions and Zeulzer believed that his extracts were toxic and abandoned his line of research.[20] Unfortunately for him but fortunately for Banting and Best his two papers in 1907 made little impact.[21]

Many years later, according to Mellinghoff, Zuezler claimed priority:

> Offenbar veranlasst durch die Nobelpreisverleihung meldete noch in gleichen Jahr der deutsche Wissenschafter GL Zuelzer (1870–1949) Prioritätsansprache für die Entdeckung des Insulin an: 'Ich habe nunwehr das recht meine Prioritätsansprache für diese – von der Allgemeinheit als sehr wichtig angesehene – Entdeckung geltend zu machen ...'
>
> [*Following the award of the Nobel Prize, in the same year the German scientist GL Zuelzer was compelled to issue a prior claim for the discovery of insulin: 'Given the perceived importance of this to the world at large I now have the right to assert my valid claim.'*][22]

Nor was Zuelzer the only one to have had a near miss with insulin. According to one of his descendants, the first extract of insulin was made a decade before Banting and Best by EL Scott who wrote a letter to the *Journal of the American Medical Association* in October 1923.[23] In the letter he claimed:

> In the summer of 1911 I developed a method for extracting a substance from the pancreas which is active in carbohydrate metabolism. The method was published in the *American Journal of Physiology* in January 1912.[24] Banting and Best stated that the principle on which this ... extract depends is the same. Banting and Best's extract of a whole normal pancreas constitutes the first repetition of my own work reported in 1911. The discovery of the curative power of insulin had been open since 1912.

Scott had achieved good results with a few diabetic dogs but blood sugar was actually raised in some animals and he abandoned his experiments in 1912.

There was also the curious case of the French physiologist E Gley who performed experiments very similar to those of Banting and Best sixteen years earlier. But in 1905 he deposited his results in a sealed envelope with the Société de Biologie de Paris. Only after Banting and Best published did Gley give permission to open the letter but, to his great chagrin, he received little credit for his work.

Banting and Best were fortunate that neither Zuelzer nor Scott finished what they had begun and Gley kept his results secret. But it was not only luck that enabled them to succeed, nor did they need to use techniques that were unavailable to the earlier workers. What they had was youth and immense enthusiasm. Neither was well qualified for what they were doing and they were both working outside their fields.[25] They had the use of the laboratory for a limited time – until MacLeod returned and saw what they had achieved – so they worked obsessively but methodically, determined to crack the problem they had set themselves and overcoming each setback as it arose. As Allen said:

> Others have reduced glycosuria and hyperglycaemia with pancreatic extracts but the fall of sugar could be attributed to intoxication ... the Toronto workers ... hold unquestionable priority for one of the greatest achievements in modern medicine.[26]

Penicillin

When Alexander Fleming wrote in his 1929 paper:

> In the examination these plates [cultured with *Staphylococcus* variants] were necessarily exposed to the air and they became contaminated with various microorganisms. It was noticed that around a large colony of a contaminating mould the staphylococcus colonies became transparent and were obviously undergoing lysis

he could have little realised that he was about to discover a substance that by the end of the twentieth century would prevent more deaths and alleviate more suffering than all cures previously known put together.[27]

Moulds and fungi were used since early times and there are records of their use in pre-Columbian Central America.[28] In the late 19th and early 20th centuries there were reports of antibacterial activity of *Penicillium* species. There were studies in 1870 by JB Sanderson who was Medical Officer for Paddington (where Fleming would do his work) and by Lister who worked with *P. glaucum*, but no clinical results were published. William Roberts, Professor of Medicine at Manchester, recognised that some fungi were antagonistic to bacteria. John Tyndall also noted that where cultures became covered with mould the bacteria sank to the bottom and the nutrient solution became clear; but he thought that that was because the mould cut out the oxygen. T.H. Huxley disagreed that this was the reason, but published no work on the subject himself.

The inhibiting effect of *Penicillium* on bacteria was rediscovered several times between 1896 and 1928 but

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this early work made little impact so there was plenty of opportunity for others to make the discovery that Fleming did.

Fleming went on holiday at the end of July 1928 and returned at the beginning of September. On his return he discarded his old cultures into a tray containing lysol. When finally examining the cultures as he transferred them into the disinfectant, he fortunately noticed something on a mould that had not reached the lysol and immediately sub-cultured it. Because he had earlier, in 1922, discovered lysozyme when he noticed that a culture of his nasal mucus had dissolved a contaminating bacterium (*Micrococcus lysoseikticus*) his observations and mind were attuned to such inhibitions of microbes which, according to Allison, happened often.[29] This version is challenged by Chen who claims that lysozyme was discovered by experiment, not by chance.[30] Wright's laboratory was devoted to the production of vaccines, from which its income derived. During the 1914-18 war anti-wound-sepsis vaccine was ineffective; vaccines were in conflict with antiseptics which were better but still not good. John Freeman, who worked in Wright's laboratory, believed that patients with allergies could be treated with mould vaccines. Allergic patients were encouraged to bring moulds from their homes and a mycologist was employed, CJ La Touche, who 'farmed' the moulds.[31] It was La Touche who identified Fleming's mould as *Penicillium rubrum*.

For the next four months Fleming carried out very thorough *in vitro* tests into the antibacterial effect of *Penicillium* and showed that high dilutions of the mould culture filtrate inhibited Gram-positive bacteria including staphylococci, haemolytic streptococci, pneumococci and diphtheria bacilli. He also found that most Gram-negative bacteria were resistant. His 'penicillin', as he coined it, being a more elegant name than 'mould juice', was harmless to leucocytes and to animals and man. He concluded that 'penicillin may be an effective antiseptic for application to, or injection into, areas infected with penicillin-sensitive microbes'.

Although colleagues at St Mary's were unimpressed by the famous plate as they had seen similar plates when lysozyme was used, Fleming had realised that this plate had been inoculated with a virulent strain of streptococcus, therefore the mould was producing an agent very effective against pathogenic organisms. As Pasteur had pointed out, 'Dans les champs de l'observation, le hasard ne favorise que les esprits préparés'.

Among all the discoveries of the twentieth century that have been attended by some good fortune Fleming is the one who has been called 'lucky' on account of the story that the mould came in through the window of Fleming's laboratory. John Mann's book even contains a section called 'Penicillin: Fleming's serendipitous discovery' in which he says, *inter alia*:

> *Penicillium* moulds ... produce thread-like hyphae ... some of [which] undergo a transformation into a reproductive form with a thick stem that has the appearance of a pencil (hence the name 'penicillin').[32]

The mould probably did not come in through the window as legend had it, as the window was always kept closed; it possibly came from the nearby laboratory of La Touche.[33] Fleming's first major experiment was to demonstrate that *B. influenzae* (which he could now isolate with penicillin, which killed off all the contaminating staphylococci) could be the cause of 'flu so that the anti-'flu vaccines made by Wright would be useful. However, *B. influenzae* was found to be responsible only for the secondary infections of 'flu; vaccine therapy was ineffective.

Fleming carried out only a small amount of further work and made only a weak attempt at extracting and purifying penicillin as he did not have the chemical or biochemical techniques to do so, and put this line of work aside. The good luck that attended this discovery was the mould alighting on (contaminating) the inoculated plate. Others had seen this happen, discarded the plate and were perhaps more careful next time, but Fleming had seen what others had seen but had realised its potential, which none of the others had.[34] But the potential that Fleming had seen was probably not as an antibiotic but as a useful bacteriological tool, helpful in the isolation of resistant bacteria. It was sulphonamides, discovered in 1935, which resulted in chemotherapy superseding vaccine therapy and immunotherapy.

The development of penicillin into a major drug, probably *the* major drug of the twentieth century, required the coming together in the 1940s of the German Ernst Chain and the Australian Howard Florey – another stroke of good fortune – to carry on the work of the Scottish Fleming. Although Fleming's contribution to penicillin as a therapeutic agent was small it was nonetheless recognised, for all three received the Nobel Prize and were knighted.

Disulfiram

Banting and Best and Fleming were looking for what they found, but sometimes a stroke of pure luck occurs, enabling a discovery to be made when the discoverer is looking for something else, as Winnie the Pooh recognised could happen.

Tetraethylthiuram disulphide, known as Disulfiram (disulphiram), was used as an antoxidant in the rubber industry. Workers exposed to disulfiram were known to be hypersensitive to alcohol but little attention was given to this. Two Danes, J Hald and E Jacobsen, who were investigating disulfiram as a fungicide and anthelmintic, were impressed by its low toxicity in animal experiments. They confirmed this by taking a substantial dose of disulfiram themselves. Not observing any trace of toxicity or side-effect they then celebrated their results with a drinks party that evening where they soon became ill. They quickly recovered and recalled that others working with the antioxidant were sensitive to alcohol.

They found that tetraethylthiuram disulphide is relatively non-toxic, the lethal dose in animals being as high as 3g/kg and daily doses of 250 to 600 mg were tolerated for several months without toxic effects. However, they found that if a person had taken 1–1.5 g

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of the substance the day previous to ingesting even a small amount of alcohol very unpleasant symptoms ensued: heat and flushing in the face, sometimes down to the chest, dilatation of the scleral vessels giving bulging eyes, palpitations and sometimes slight dyspnoea. Acetaldehyde could be smelled on the breath. After a larger dose of alcohol there was nausea and headache, all effects disappearing after a few hours. The effect lasted from 3 to 8 days depending on the dose.[35] They worked out the metabolic pathway of alcohol from disulfiram to acetaldehyde. From this came the aversion drug now marketed by Berk as Antabuse. The drug was shown to act clinically by Martensen-Larsen who treated 83 patients with disulfiram and obtained promising results in 74 of them.[36]

Lesser scientists than the two Danes might not have made the connection between what they had taken some hours earlier and what happened at a cocktail party; or they may have made the connection, even recalled the sensitivity of the rubber workers, and made a note to warn people using it as a fungicide or anthelmintic to avoid alcohol. But they recognised a potential usefulness and did enough further work to establish a useful product for use with alcoholics.

Conclusions

What is it that has enabled some scientists to make the most of whatever luck has come their way while others seem to fail to notice their good fortune? To some extent it is their thought processes, the ability to think laterally, to see new possibilities in old patterns. But it is also a matter of technique without which science cannot progress.

Zuelzer remarkably failed to see that a range of strengths of his extract would have demonstrated its efficacy. Banting and Best used a similar extract, but they monitored theirs by measuring the test animals' blood sugar level against the concentration. Can one say that the Toronto workers were lucky? They had the persistence to succeed where earlier workers had failed and to call in other experts when needed. Zuelzer could have obtained a less toxic extract for there was no shortage of first-rate chemists in Germany at the turn of the century: they had not yet begun to pack their bags. But he gave up, as did Scott and the others.

The antibacterial action of moulds had long been seen and recognised; it had even been crudely used by smearing the mould over affected areas. Fleming may have been lucky in that it was *Penicillium* that landed on his plate, but there the luck stopped and technique took over. Fleming was methodical and as he discarded his plates he examined them and noticed that the mould on one plate did not just kill some bacteria but lysed a virulent strain of streptococcus and that the mould was worth subculturing so that it could be further examined.

The physiological effect of alcohol on people exposed to disulfiram had long been known but it took the two Danish scientists to recognise its aversion potential and carry out the necessary experimentation to bring the drug to the market.

All this is true but it is not enough: academic scientists working in universities cannot alone bring their discoveries to a condition where they can be marketed and used. Fleming saw the microbiological usefulness of penicillin for making differential cultures but when he found that it was destroyed by heat and too labile for extraction he abandoned it. Therefore the credit for the discovery of penicillin *as a therapeutic agent* must be given to those who first isolated it and demonstrated its clinical usefulness: Florey, Chain and their colleagues.[37] Credit must also go to the pharmaceutical companies who developed techniques for the large-scale manufacture of the drug.[38] Brunel goes further: he believes that Fleming was unfairly given credit for the discovery of penicillin as he was one of a long line of researchers in the same field, starting with Pasteur.[39] There is some force in this argument, but in the real world the force was with Fleming. How far back should one look ? Supposing Chain had stayed in Germany or Florey had stayed in Australia? The development of penicillin needed the trigger of Fleming, the clinical work and extraction technique of Florey, and Chain for the chemical identification.[40] Not forgetting the American pharmaceutical laboratories which were instrumental in the large-scale manufacture of a usable product.

Were Banting and MacLeod lucky to get the Nobel Prize? Banting was unarguably the most worthy: it was his idea and he was a dogged worker. Could the committee award the Prize to Banting and Best, an unknown physician and a new graduate? No: it was inconceivable that they, so inexperienced in laboratory work, could have carried the work to fruition alone, or that MacLeod, who had been in the field for eighteen years, had not directed the research. Moreover, it was MacLeod who had seen the need for a chemist, and it was he who negotiated with Lilly, without whom (or a like company) 'pancreatic extract' would have remained a laboratory curiosity, out of reach of dying diabetics. It had to be at least Banting and MacLeod and the Prize could be shared by no more than three. Best was mint-new to research but was there from start to finish; Collip, whose contribution was vital, came late to the team.

Luck does happen to scientists but only scientists who have the skill, techniques and determination to exploit their good fortune to a useful conclusion. The old Yiddish proverb expresses it perfectly:

When luck enters the game, clever scores double.

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The 2005 edition of the calendar (cover below) is illustrated with twelve colour plates of objects from the Pharmacy Museum of Bressanone, Italy, with detailed descriptions in German and English.

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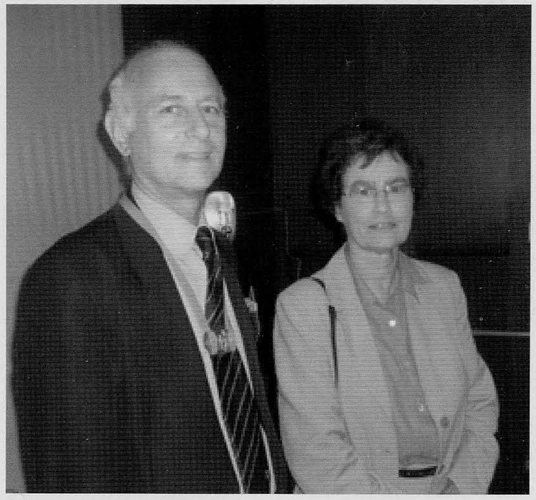
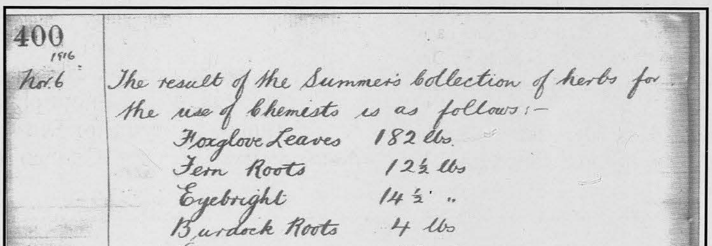
Prof. Wolf-Dieter Mueller-Jahnke, Heidelberg, President of the International Academy for the History of Pharmacy, who presented a paper on the history of the Academy (p.49) at the BSHP Spring Conference 2004.

The Academy will have a meeting in Edinburgh on Thursday 23rd June 2005, during the 37th Congress for the History of Pharmacy. The Academy Lecture on 'Community Pharmacy and the Rise of Welfare in Great Britain during the 20th Century' will be given by Dr Stuart Anderson.



Pat Stone (right), who spoke on the 'Centenary of Pharmacy at Whipps Cross Hospital' in September, with BSHP President Dr Stuart Anderson.

Copy of a page from the log book of Gillamoor School, North Yorkshire, recording collection of local herbs in 1916. Courtesy of Mrs GW Goodall, Kirkby Moorside, North Yorkshire



400

1916 Nov. 6	The result of the Summer's Collection of herbs for the use of Chemists is as follows:- Foxglove Leaves 182 lbs. Fern Roots 12½ lbs Eyebright 14½ .. Burdock Roots 4 lbs Agrimony 2½ .. Common Avens 10¾ ..
Nov. 29th	Children were given the annual Martinmas Holiday this day.
Dec 8th	School closed this afternoon to prepare the room for a Concert tonight, in aid of the "Comforts' Fund" for the soldiers who have gone from the two villages here.
Dec. 22nd	Christmas Holidays begin. - 2 weeks.
1917 Jan 8th	School reopened this morning. 52 present out of 55 on roll.
Feb. 19th	33 present this morning out of 55 on roll. The absent 22 have most of them bad coughs & colds. A large percentage of the children at school are

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A selection of labels from Leslie Matthews' collection. Courtesy Dr Nita Burnby.
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